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ENERGY FACILITY SITE 21530-20/Sumas2  
EVALUATION COUNCIL

Irina Makarow  
Energy Facility Site Evaluation Council  
925 Plum Street SE, Building 4, Third Floor  
PO Box 43172  
Olympia WA 98504-3172  
USA

Dear Irina Makarow:

Re: Draft Supplemental Environmental Impact Statement for Sumas 2 Energy

This letter provides comments from the British Columbia Ministry of Water, Land and Air Protection on the draft Supplemental Environmental Impact Statement (SEIS) for the Sumas 2 Energy Generation Facility.

As you know, British Columbia is an intervenor in the EFSEC review of the Sumas 2 proposal. Rather than provide detailed comments on the SEIS, we draw your attention to our pre-filed testimony in those proceedings (a copy of which is attached), which is relevant to the areas on which comment was invited on the SEIS. It also contains comments on the issue of air quality because of the importance of air quality in public consideration of this matter and its evident importance in EFSEC's Order 754.

Thank you for the opportunity to comment.

Yours truly,

Margaret Eckenfelder  
Assistant Deputy Minister

Attachment



cc: Don Fast, Environment Canada  
Johnny Carline, Greater Vancouver Regional District  
Gerry Kingston, Fraser Valley Regional District  
Peter Andzans, City of Abbotsford  
Mary Barrett, Counsel for the Environment, Washington

BEFORE THE STATE OF WASHINGTON  
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION  
FACILITY

Exhibit \_\_\_\_\_ (DVB-T)

PRE-FILED TESTIMONY OF DAVID  
BATES

**Q: Please introduce yourself.**

**A:** My name is David Bates.

**Q: What is your background and experience?**

**A:** I am a physician with 50 years of experience in occupational and environmental medicine, specializing in respiratory disease related to air pollutants. I am a consultant to the international scientific and regulatory communities on matters of environmental medicine, air pollution, science policy, and medical education. I have served and/or continue to serve on numerous government advisory bodies including the National Academy of Science (Board of Environmental Studies and Toxicology); United States EPA Science Advisory Board on air pollution and health related matters; and the Lower Fraser Valley Air Quality Advisory Committee. I have served as a visiting professor at various universities including Harvard, Johns Hopkins, and McGill University. I continue to serve as a Criteria Document peer reviewer for the United States EPA Clean Air Science Advisory Committee.

I have been an independent consultant in occupational environmental medicine since 1987. Prior to that, for 15 years I was on the faculty at the University of British Columbia, including time as the Dean of the Faculty of Medicine. Prior to that, I was at McGill University where my roles included being chair of the Department of Physiology and Associate Dean of the Faculty of Medicine. My background is further described in my curriculum vitae. Exhibit \_\_\_\_ (DVB-1).

**Q: What is the subject of your pre-filed testimony?**

**A:** My testimony deals with the health effects associated with the increased pollution predicted to result from the SE2 facility. However, I understand that this is the resumption of hearings that initially took place last year and that the scope of these hearings is limited to considering the implication of changes in the project as

described in SE2's Second Revised Application. I have focused my efforts within that limited scope.

**Q: What work have you undertaken to address these issues?**

A: I am continually reviewing new scientific studies related to air quality and related health effects. Specific to this matter, I have reviewed relevant sections of the following documents:

- The Second Revised Application (Jun., 2001).
- The First Amended Application (Jan., 2000).
- EFSEC Order No. 754.
- The Pre-Filed Testimony of Applicant's witnesses Eric Hansen and Sanya Petrovic.

**Q: Can you summarize your conclusions based on this review?**

A: Yes. First, given the limited scope of this round of hearings, I will not re-hash the old evidence germane to establishing that adverse health effects do occur at levels below regulatory standards. (I understand Robert Caton's testimony demonstrates the failure of Ms. Petrovic to observe this limitation). However, there are new health studies that do have relevance. By "new," I mean studies that have been published subsequent to the close of the hearings last fall. These new studies have *not been cited or discussed by Ms. Petrovic. These studies confirm the other studies already cited in the record which establish that serious health effects do occur below the regulatory standards.*

Second, Ms. Petrovic argues, in essence, that SE2's emissions will be slight in comparison to background conditions and that this slight increase will not have any demonstrable health effects. I note first that Ms. Petrovic's testimony is apparently based on inaccurate or incomplete projections of the facility's emissions, as detailed by Mr. LePage. In any event, Ms. Petrovic is wrong because the facility's proposed additions to background pollution levels can be expected to increase the incidence of adverse health effects.

Third, and related to the prior point, Ms. Petrovic's testimony is at odds with the vast body of scientific literature that indicates that there is no threshold below which these pollutants do not cause health problems and that, as these pollution levels increase, so does the risk of adverse health impacts. Indeed, her characterization of the more lenient standards as being a compromise between protecting health and allowing for new development is an implied acknowledgment that adverse effects occur below those politically established levels.

Fourth, Mr. Hansen is incorrect in suggesting that the Council should focus on health effects caused by short-term exposures to air pollution and apparently ignore or give little weight to health effects caused by long-term exposures. Both short and long-term exposures are important from a health effects perspective. That's why, among other things, air pollution standards and guidelines address both short-term and long-term exposure levels.

**Q: Let's start with your first point. While the Council already has determined that health effects occur below the level of Canadian standards and objectives, the Council may desire to learn of new information (subsequent to the last hearing) pertaining to this issue. If so, are there any new health studies published since the close of the first round of hearings last fall that are germane to this issue?**

A: Yes. There was a study published very recently that demonstrates the onset of adverse health effects in humans that are exposed to ozone and soot (small particulate matter) at levels below the Canadian objectives and standards. The study was conducted in Atlanta, Georgia at the time of the summer Olympics there in 1996. Due to a *decrease* in vehicle traffic during the Olympics, there was a 20 ppb reduction in ozone levels. The study found that this was associated with a 35 percent reduction in hospital admissions of children with asthma. At all times, ozone levels were below both the current United States and Canadian standards for ozone. (The paper is entitled "The Impact of Changes in Transportation and Commuting Behavior During the 1996 Summer Olympic Games in Atlanta on Air Quality and Childhood Asthma." It is authored by Friedman and others and was published earlier this year in the Journal of the American Medical Association, Volume 285, pages 897-905.)

**Q: Does Ms. Petrovic base her "no adverse health impacts" conclusion on anything other than her comparison of SE2 induced pollution levels to Canadian standards and objectives?**

A: Yes. Early in her testimony, she identifies a second basis for her "no adverse health impacts" conclusion. She asserts that because the increases in particulate matter and ozone from the SE2 facility will be a small fraction of current background concentrations that there will be no adverse health impacts from those emissions. Exhibit 183 at 6:20-29. She elaborates on this briefly near the end of her testimony at pages 21-22.

**Q: In your summary at the outset of your testimony, you stated that you disagreed with that part of her testimony, too. Could you please expand on that point now?**

A: Yes. As I mentioned at the outset, there are really two problems with this part of Ms. Petrovic's testimony. First, her analysis is based on emission levels and projected concentration levels that do not take into account peak emissions that apparently will occur during start-ups and shut-downs. This matter is discussed in greater detail in Michael LePage's testimony. But the point here is to relate that oversight to the health effects analysis. This part of her testimony is based on the amount of emissions from the facility, yet she is apparently relying on information that underestimates those emissions.

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But the more important point, really, is that Ms. Petrovic simply is wrong to assert that increases in pollution do not translate to increases in adverse health effects. For both of the pollutants at issue here, small particulate matter and ozone, it has long been recognized that as the concentration increases, so does the risk of adverse health effects. The Atlanta study I mentioned demonstrates that. So do two other recent ones.

One of them was a study of 6,000 school children in Los Angeles. The authors found that an increase of 20 ppb of O<sub>3</sub> [ozone] was associated with an increase of 62.9 percent for illness-related absent rates, 82.9 percent for respiratory illnesses, 45.1 percent for upper respiratory illnesses, and 173.9 percent for lower respiratory illnesses with wet cough. Gauderman, et al., "*The Effects of Ambient Air Pollution on School Absenteeism Due to Respiratory Illness*," 12 *Epidemiology*, 43-54 (2001).

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The other was conducted in Boston, Massachusetts, and reported a highly significant association between the occurrence of acute heart attacks in 772 individuals and the level of particulate pollution. Peters, et al., "*Increased Particulate Air Pollution and the Triggering of Myocardial Infarction*," 103 *Circulation*; 2810-15 (2001). All of these studies corroborate the findings of earlier studies that indicate that as exposure increases, so does the risk of adverse health effects and that there has been no demonstrated threshold below which these effects do not occur.

By the way, I notice that in this part of her testimony (pages 21-22), Ms. Petrovic cites no studies (old or new) to support her assertion that increases in pollution do not increase health risks.

Furthermore, later in her testimony she effectively contradicts herself. When speaking about the offsets proposal, she states that efforts to improve air quality by offsetting emissions or funding other air quality improvements will have a "positive" effect on health. I agree that when we reduce air pollution, that has a positive impact on health risk. But, then, the converse is necessarily true, too. When pollution increases, there is an adverse impact on health risk. Ms. Petrovic cannot logically claim that decreases in pollution from an offset program will be

protective of health and at the same time claim that increases in air pollution will not have an impact on health.

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**Q: Mr. Hansen suggests that the Council's focus should be on peak levels of pollution, not annual averages. Do you agree?**

**A:** No, there should be focus on both. If the health studies indicated that only peak levels were of concern, then you would see regulatory standards expressed only in terms of short-term peak values. Instead, the health community recognizes that both long-term and short-term exposures are important from a health perspective. The Joint Technical Report (Exhibit 162.12) demonstrated that the primary health effects from exposures to particulates were due primarily to the long-term elevation of ambient concentrations of particulate matter, not the short-term peaks associated with burning diesel.

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**Q: In light of the changes SE2 has made to the project, how would you assess the need for the Council to revise its determination that Sumas is not an appropriate location for this project from a public health standpoint?**

**A:** I see no need for the Council to revise that determination. The reductions in emissions attributable to the changes in the project are very slight and therefore the reduction of adverse health effects would be very slight, too.

Further, it is my understanding that the emissions of some pollutants are increasing. For instance, I understand that (apparently because of an error in the earlier application) the current application shows a large increase in the emissions of sulphuric acid mist and sulphur dioxide. When released into the atmosphere, these pollutants react with other chemicals and create very small particulates, i.e., PM-2.5. Thus, these new, higher emission levels for sulphuric acid mist and sulphur dioxide would be expected to have an adverse effect on health.

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Essentially, the magnitude of the adverse health effects that supported the Council's conclusions last time remain virtually the same. Last time the Council determined that this "polluted, confined, highly populated and rapidly growing area is not an appropriate site in which to locate a power plant, which would emit three tons a day of criteria and toxic pollutants." Council Order No. 754 at 51 (Finding 47). The information that this valley is "polluted, confined, highly populated, and rapidly growing" has not changed. The slight reduction in emissions (six or seven percent reduction, at best, ignoring potentially higher levels during start-up and shut-down) does not warrant a change in the Council's fundamental conclusions.

### **END OF TESTIMONY**

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BEFORE THE STATE OF WASHINGTON  
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION  
FACILITY

Exhibit \_\_\_\_\_ (JGL-T)

PRE-FILED TESTIMONY OF  
JERRY LILLY

**Q: Please state your name and business address.**

A: Jerry G. Lilly  
JGL Acoustics, Inc.  
5266 NW Village Park Drive  
Issaquah, WA 98027

**Q: What subjects do you intend to address in your testimony**

A: I will address issues relating only to environmental noise emissions from the proposed facility.

**Q: Could you describe your background and experience?**

A: I hold a Master's Degree in Engineering Acoustics from Penn State University (1975) and a Professional Engineering license in Acoustical Engineering from the State of Oregon (1983). I am a Board Certified member of the Institute of Noise Control Engineers, and I am active in ASHRAE (American Society of Heating, Refrigerating and Air Conditioning Engineers), ASA (Acoustical Society of America), and NCAC (National Council of Acoustical Consultants). I recently completed a two-year term as President of the National Council of Acoustical Consultants (1996-1998). I am president of my own consulting firm, JGL Acoustics, Inc. in the Seattle metropolitan area. I started my firm in 1983, and I provide consulting services in architectural acoustics, industrial and mechanical noise control, and environmental noise assessment and control.

In addition to my 25 years of acoustical consulting experience, I taught two courses in Acoustics at the University of Washington (1981 & 1988). I have also published several technical papers in acoustical journals and periodicals, and I am one of ASHRAE's regular professional development seminar speakers. A copy of my resume is submitted as Exhibit \_\_\_\_ (JGL-1).

**Q: In preparation for this hearing, what documents did you review?**

A: I have reviewed the following materials for this testimony:

Pages 3.3-1 through 3.3-12 of the Sumas Energy 2 Final EIS (Volume 1)

Pages 4.1-1 through 4.1-15 of the Sumas 2 Generation Facility EFSEC Application 99-1 (revised January 10, 2000)

Pages 4.1-1 through 4.1-15 of the Sumas 2 Generation Facility EFSEC Application 99-1 (revised June 29, 2001)

Pages 3.4-1 through 3.4-8 of the Sumas Energy 2 Draft SEIS (undated)

Applicant's Prefiled Direct Testimony of Frank Brittain, Ph.D. (undated)

September 11, 2001 letter from David Bricklin to Karen McGaffey

Response to Low Frequency Noise Data Request (pages 4 through 8, dated 9/20/01)

**Q: In Council Order No. 754 (at 41), the Council found that "the computer modeling conducted by the Applicant is insufficient to assess the probable noise level that would be emitted from the proposed plant, whether that noise level would comply with relevant legal standards, and what effect it might have on the health and comfort of the local population." Does the Second Revised Application include any new computer modeling to address any of those shortcomings identified by the Council?**

A: No. The only changes reflected in the Second Revised Application pertaining to noise relate to a post-construction monitoring program. There is no new computer modeling presented.

**Q: Is there some other method of analyzing noise impacts (other than computer modeling) that was used by the Applicant in the Second Revised Application to respond to the Council's finding that the prior noise analysis was deficient?**

A: No. There was no additional analysis of any kind provided by the Second Revised Application. The Second Revised Application does include a tabular listing of the octave band sound power levels (Table 4.1-5) for the most significant noise sources associated with the project. This list includes the 31.5 Hz and 63 Hz octave bands, which would constitute the majority of the low frequency noise. However, these data represent estimated source strengths, not the sound levels expected at the receiver locations. Presumably, these data were input into the computer modeling effort that was used to generate Table 4.1-6. It should be a relatively simple task to create a new table that presents the calculated octave band low frequency sound pressure levels at the various receiver locations. However, this information has not been provided by the Applicant.

I would like to point out that in my review of the above-mentioned documents, there has been very little discussion about tones. I am fearful that too much emphasis is being placed on low frequency noise and people are forgetting about tones. There are certain pieces of equipment that are known to create significant audible tones. This

equipment includes (but is not limited to): high-speed axial fans, radial blade and radial-tip blade centrifugal fans, and transformers. Usually the frequencies of the tones are known early in the design phase of the project. The acoustic modeling effort should account for these tones by tagging the octave bands that contain tones for each noise source that has been identified as containing significant tones. Then, when evaluating the receive sound level at each receiver, check to see if the predicted total octave band sound level is at least 10 dB above the octave band level of the tonal source(s). If the predicted tone level is close to the predicted total sound level in that octave band, additional attenuation is required for the tonal source. Note that additional attenuation may be required even if the total A-weighted sound level is within the noise ordinance requirements. Taking these additional steps does not necessarily require a repeat of the entire modeling effort. It merely involves taking the time to identify which sources contribute tonal energy at each of the various receiver locations.

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**Q: Are the deficiencies in the computer modeling analysis identified by the Council in Order No. 754 relevant to British Columbia residents?**

A: Yes. As I testified during the last hearings, the project may well emit tones and low frequency noise that could impact people in British Columbia. The Second Revised Application continues to omit any evaluation of these important issues.

For instance, the noise monitoring program now proposed by the Applicant is to extend to a distance of 3.5 miles. That's considerably greater than the distance from the plant to the Canadian border. Obviously the Applicant recognizes that there is a possibility for noise impacts intruding into British Columbia yet impacts in British Columbia are not analyzed in the application.

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**Q: The Second Revised Application does include a new proposal for monitoring noise after operation commences (Ex. 181.3 at 4.1-15). Does that monitoring program address your concerns?**

A: Some, but not all. The noise monitoring program in the Second Revised Application is defective because it apparently excludes British Columbia. The Second Revised Application states that the monitoring plan will include a minimum of 12 locations up to a distance of 3.5 miles from the plant. But there is no guarantee that any of those 12 locations will be in British Columbia (even though, as I mentioned earlier, a 3.5-mile circle around the plant would include a substantial amount of property in British Columbia). The applicant's prior modeling of noise impacts excluded consideration of impacts in British Columbia. Without an express statement that the monitoring program *will* include locations in British Columbia, we cannot assume that that will be the case.

In fact, it appears that the applicant has no intention of including British Columbia in the noise monitoring program. The Second Revised Application states that SE2 will

select measurement locations in concert with the City of Sumas or Whatcom County staff. Presumably if the applicant intended to include British Columbia sites in the monitoring program, there would be a reference here to including the Province in this effort. Similarly, the Second Revised Application states that if "the City [of Sumas] and [Whatcom] County noise regulation staff jointly agree" that low frequency sounds or tones are reasonably objectionable, then SE2 will respond. Ex. 181.3 at 4.1-15. Again, the omission of acoustical engineers from British Columbia suggests that the Applicant has no intention of including British Columbia in this noise monitoring program.

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**Q: In addition to the apparent exclusion of British Columbia, what other deficiencies do you see in the proposed noise monitoring program?**

A: Another concern that I have relates to the time frame of the noise monitoring and the implementation of noise mitigation. In fact, the proposal requires that the initial monitoring report not be submitted to EFSEC until after the facility has been in operation for an entire year. If there are significant noise impacts (on either side of the border), that is a long time for those impacts to be endured by the neighbors. Plus, the one year mark is only when the initial report is filed with EFSEC. There is no commitment in the application to any time frame beyond that within which curative measures will be in place.

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I recommend that the initial noise monitoring report be filed within 60 days of the commencement of plant operation. The report should present both pre-construction and post-startup ambient noise levels and spectra at each measurement location. If the measurements show that noise levels do not comply with the noise ordinance(s) or if excessive low frequency noise or tones are discovered, the report should also specify a specific mitigation plan and a time within which curative measures will be in place. That time frame is a little harder to specify because the amount of time reasonably necessary may well vary depending on what type of mitigation measure is required. Nonetheless, a time frame presumed to be reasonable could be established leaving the Applicant the option of requesting additional time if it could make the case that more time was reasonably necessary. For most curative measures that I could envision, 90 days ought to be a sufficient amount of time to make the necessary changes.

**Q: What other concerns do you have about the noise monitoring and post-operation noise mitigation proposal?**

A: The proposal does not indicate specifically how the applicant plans to monitor the low frequency noise and tones radiating from the plant. I was expecting to see a statement that the applicant will measure (in addition to the A-weighted Leq and L<sub>N</sub> statistics as a function of time of day) the background noise spectrum in 1/3-octave bands from 20 Hz to 10,000 Hz at each measurement location. The background noise spectrum should be measured over a minimum time period of 60 seconds over

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an interval of time when there are no audible transient noise sources (e.g. aircraft, local street traffic, etc.). Ideally, the background noise spectrum data should be collected between the hours of 12:00 am and 5:00 am to minimize the potential of contaminating data from transient sources. I would also like to point out that an assessment of tones is impossible if the measurements are conducted in octave bands.

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I would also like to reiterate that the best time to address noise problems is during the design and permitting phase. If noise problems emerge after the plant is built, it is generally much more difficult and more expensive to resolve. Inevitably, what constitutes a reasonable noise mitigation measure after the fact is judged, in part, by how expensive and difficult it is to implement. The best way to incorporate noise mitigation is at the front end before the facility is built.

**Q: The Applicant's noise witness, Frank Brittain, suggests that if proper attention is paid to noise issues during the detailed design phase, no low frequency noise or tone problems should occur. Ex. 191 at 5-8. In particular, Dr. Brittain states: "From personal discussions with Dave Eaden of SE2, I understand and have been assured that SE2 is serious about meeting the noise requirements. This includes making sure that noise is adequately addressed during the detailed design phase, and the noise controls needed will be installed." Ex. 191 at 7:31-37. Are the assurances that Frank Brittain references incorporated in the Second Revised Application?**

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**A:** No. Frank Brittain identifies a number of details that ought to be included in the detailed design of this facility to minimize the risk of low frequency and tone noise problems. None of his specific recommendations are included in the Second Revised Application. I would think that if EFSEC wants assurance that Dr. Brittain's recommendations are going to be addressed by the Applicant during the detailed design phase and during construction, that they should be set forth in the application and included in the Site Certification Agreement (if one is issued).

## END OF TESTIMONY

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BEFORE THE STATE OF WASHINGTON  
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION  
FACILITY

EXHIBIT \_\_\_\_ (MFL-T)  
PRE-FILED TESTIMONY OF  
MICHAEL LEPAGE

**Q. Please introduce yourself.**

A. My name is Michael Lepage. I am a Certified Consulting Meteorologist and Project Director with Rowan Williams Davies & Irwin Inc., with 20 years of experience on air quality issues. Currently, I am involved in air quality modeling for two proposed 800 MW gas turbine power plants in Ontario. I have previously overseen air modeling studies for other gas turbine plants in Ontario and one in Bangladesh. I have also overseen air modeling and baseline monitoring programs for proposed engine-driven power plants (100 to 200 MW) in Ecuador, Kenya, Vietnam, Pakistan and Bangladesh, and I have been involved in miscellaneous air modeling studies for coal-fired power plants.

Over the past three years, I have headed up a regional air quality modeling effort for the Lower Fraser Valley, to predict ground-level ozone and other pollutants during summertime smog events. The project was sponsored by Health Canada as part of their ongoing research on the effects of alternative passenger vehicles on air quality and human health in the Valley. Over the same time period, I headed up a regional air quality modeling research program in Eastern Canada, which included studies focused on existing and proposed power plants in the region, and participated in a major regional modeling study for Southern China. My background is described further in my curriculum vitae. Exhibit \_\_\_\_ (MFL-1).

**Q. What is the subject of your pre-filed testimony?**

A. My testimony deals with the air quality modeling that was performed by MFG to assess the air quality impact of the Sumas 2 project, and the effect of the changes made in the most recent EFSEC application. Specifically, I will discuss the following issues:

- effect of the changes on short-term peak pollutant emissions;
- effect of the changes on annual average pollutant emissions;
- effect of the changes on ground-level ozone;
- effect of the changes on regional haze and visibility;
- effect of the changes on particulate matter.

**Q. What work have you undertaken to address these issues?**

**A.** I have reviewed the following documents:

- Section 6.1, Sumas2 Generation Facility EFSEC Application 99-1, Second Revised Application, June, 2001;
- EFSEC Council Order No. 754;
- Sumas Energy 2 Generation Facility Air Quality Issue Summary, LFVAQCC, September, 2000;
- The Draft Supplemental EIS, EFSEC (by Jones & Stokes), September, 2001;
- A numerical simulation of impacts on ground-level ozone concentrations from the proposed Sumas Energy 2, Inc. power generation facility, by C. di Cenzo and J. Pottier of Environment Canada, January, 2000, revised in April, 2001;
- Applicant's Prefiled Testimony, Eric Hansen.

**Q. Can you summarize your conclusions based on this review?**

**A.** Yes. My testimony can be summarized as follows:

- Ignoring higher emissions due to start-up and shut-down, reductions in annual average concentrations due to the changes in the proposed power plant will generally be small. The total annual emission of all pollutants is about 16% lower than previously considered by EFSEC (due in large part to reductions in ammonia). In the case of the two pollutants that were most discussed last time, PM<sub>10</sub> and NO<sub>x</sub>, the annual emissions will be reduced by only six percent and seven percent respectively. A further reduction of about 10% in maximum ground-level concentrations is added to this, due to the increased stack height, but the overall reduction in concentration remains small. In the case of SO<sub>2</sub>, annual emissions will actually increase by 50%.

When higher emissions and higher ground-level concentrations during start-ups and shut-downs are factored in, the annual average concentrations of NO<sub>x</sub>, VOC's and CO may actually be substantially higher than predicted, and may even be higher than described in the prior application.

- With backup oil firing eliminated, the maximum short-term emission will be associated with start-ups and shut-downs. The Second Revised Application (and the Applicant's Pre-Filed Testimony) fails to analyze the peak emissions

from start-ups and shut-downs. For some pollutants (NO<sub>x</sub>, CO and VOC's), the maximum short-term emissions will not be reduced to the extent indicated in the application, and may even be higher than those previously considered by EFSEC.

- The changes to the proposed power plant have only a small effect (no more than a 10% reduction) on the previously predicted ground-level ozone concentrations. However, if start-ups were to occur in the daytime during smog events, they could lead to a significant increase in the predicted maximum 1-hour ozone concentrations.
- The effect of the proposed changes on predicted maximum ground-level concentrations of particulate matter cannot be fully determined, because the Applicant's analysis does not fully account for the creation of particulate matter after the plume leaves the stack (so-called secondary formation), and does not account for the effect that higher emissions during start-up will have on the secondary formation.
- By itself, the elimination of backup oil firing leads to a small reduction in potential impacts to visibility in the Abbotsford area. This reduction, however, is offset by shortcomings in the modeling used for this analysis, larger SO<sub>2</sub> emissions than previously forecast, and the possible effects of higher NO<sub>x</sub> and VOC emissions and higher ground-level concentrations during start-ups and shut-downs. Overall, when comparing the real visibility effects of this application to those presented in the previous application, it is impossible to conclude that there will be a noticeable benefit to visibility.

**Q: In Order No. 754 at page 23, the Council concluded that with diesel backup, the proposed power plant would emit "too much pollution into an already polluted, sensitive, highly populated, and physically constrained airshed." As a result of the changes in the project identified in the Second Revised Application, what impact will there be on the amount of pollution emitted into this airshed?**

The following table provides a comparison of the annual emissions that were considered by EFSEC previously and those that are presented in the current application:

	Order No. 754 (Tons/Year)	Current Application (Tons/Year)	Percentage Change
NO <sub>x</sub>	156	144.5	-7
CO	106	88	-17
SO <sub>2</sub>	45	69	+50
VOC	156	153	-2
PM10	223	209	-6
NH <sub>3</sub>	279	139	-50
H <sub>2</sub> SO <sub>4</sub>	9.3	14.3	+50
<b>TOTAL</b>	<b>974</b>	<b>817</b>	<b>-16</b>

**Q: Does the table of annual emissions you just presented take into account the peak emissions that occur during start-up and shut-down?**

A: No. During start-up and shut-down, emissions of NO<sub>x</sub>, CO, VOC's are significantly higher. The annual emission projections in the application are based on continuous operation, and do not take start-ups and shut-downs into account.

**Q: How much difference does it make if the different emission rates during start-up and shut-down are taken into account?**

A: It has a big impact on short-term peak emissions, and a smaller impact on the annual emissions shown above. The magnitude of the impact depends on the details of the start-up cycle, the annual number of start-ups and shut-downs and the overall operating time of the plant. Using realistic assumptions that I will detail later, I estimate that annual VOC emissions are about 1.75 times greater than those based on continuous operations (i.e., 268 tons/year instead of 153 tons/year). Annual CO emissions are about 10% greater (97 tons/year instead of 88 tons/year). Annual NO<sub>x</sub> emissions, on the other hand, are reduced by about 10%, and emissions of other pollutants would be reduced by 10 to 15%. The overall annual emission of all pollutants would be about 860 tons/year instead of 817, or only 12% lower than that previously considered by the Council.

**Q: Are there any other differences during these transition periods that affect the air quality analysis?**

A: Yes. In addition to different emission rates, the plume height tends to be lower during start-up and shut-down. A lower plume height means higher ground-level concentrations of all pollutants, which adds to the effect of the increased emissions. Again the magnitude of this effect is related to the details of the start-up cycle, which are not provided in the application nor in the Applicant's pre-filed testimony.

**Q: How about the overall impact. Taking into account both the elimination of diesel and the differences in emission rates and dispersion patterns during these transition periods, would you expect the annual pollutant concentrations due to the facility to be more or less than predicted in the former application?**

A: Taking account of all these factors, the maximum annual average pollutant concentrations for at least NO<sub>x</sub>, VOC's and CO could be equal or higher than those presented in the former application. Annual average concentrations of SO<sub>2</sub> will also be higher, due to the higher estimate of sulphur levels in the natural gas in the current Application.

**Q: You mentioned before that you would explain later how you estimated the effect of transition periods (start-up and shut-down) on the annual emissions. Would you explain that now, please?**

A: Order No. 754 indicated that the proposed PSD air emissions permit allows for up to 200 start-ups and shut-downs per year and that there are potentially 1200 hours/year of emissions that are not accounted for in the total emissions. This is more than triple the number of hours of operation on diesel oil that was assumed in the previous application for the worst-case year (15 days or 360 hours), and about 5 times the amount of diesel operation taking into account the applicant's prior commitment to limit it to 10 days per year (rolling average).

The information I have seen for gas turbine power plants in Ontario indicates that VOC emissions during start-ups and shut-downs could average 10 times higher, and peak CO emissions could average 3 times higher than during normal operations. The peak 1-hour VOC emission could be 20 times higher, and the peak 1-hour CO emission could be 5 times higher than during normal operations. For one of the pollutants of greatest concern here, NO<sub>x</sub>, the emission rate during these transition periods averages about the same as normal operations, but the peak 1-hour emission can be 40% higher. Each start-up cycle spans a period of 3 hours and each shut-down cycle spans 1 hour.

Using this information and the total number of start-ups and shut-downs requested by the applicant in its prior submissions to EFSEC (200 days/year), I forecasted the

effect that these transition periods will have on annual emissions. I assumed that, on 200 days/year, the plant begins shutting down at the end of the peak demand period (around 11:00 PM), is off for about 4 hours, goes through a 3 hour start-up period, and then is fully operational throughout the peak demand period (from about 7:00 AM to 11:00 PM). For the remaining 165 days, I made the same assumption that the applicant made for 365 days, i.e., that the plant operates continuously at full load.

2

**Q: SE2's Application and Pre-Filed Testimony highlights much higher percentage reductions in various emissions than what you have shown in your table. What is the basis for those claims?**

**A:** SE2 focuses on reductions in short-term (peak) emissions which, under the backup oil firing option, would have been allowed to occur on 10 days per year maximum, on average. Therefore, while peak short-term emissions may drop significantly, the emissions over the entire year decrease by only a small amount.

Previously, the peak emissions were presented as being associated with the plant's burning of diesel fuel under full load. In fact, the real peak emissions for some of the pollutants would have been associated with burning of diesel fuel during start-up and shut-down. Experience with other gas turbine power plants equipped with catalytic emission controls suggests that maximum short-term emissions are not associated with full load but, instead, are associated with start-up conditions when the turbines and the emission control devices are not yet fully warmed up. The air quality impacts associated with start-up and shut-down emissions have not been addressed in the application.

3

Under the current proposal, the peak emissions will be associated with burning natural gas during start-up and shut-down. As I mentioned earlier, my experience with start-ups for proposed gas turbine plants in Ontario has been that VOC emissions peak at a rate up to 20 times higher, CO emissions peak at a rate five times higher, and NO<sub>x</sub> emissions peak at a rate 1.4 times higher than during normal full load operations. As a result, maximum short-term emissions of CO and VOC will be significantly higher than those previously considered by the Council, under oil firing at full load. Maximum short-term emission of NO<sub>x</sub> would remain lower than previously considered, but not as much lower as indicated in the Second Revised Application. With the lower plume rise during start-up, the maximum short-term, ground-level concentrations of NO<sub>x</sub>, CO, and VOC's could all be much higher than previously considered by the Council.

**Q: Do you have any other concern with the way in which the Applicant has presented its claim of reduced emissions?**

**A:** Yes. SE2 claims a 33 percent reduction in NO<sub>x</sub> emissions when burning natural gas, but really there is no reduction at all. In making that statement, I am assuming

that the point of comparison is the project considered by EFSEC in its Order No. 754. In that order, EFSEC considers a facility that would be emitting NO<sub>x</sub> at the rate of two parts per million. As the Council described it: AThe Applicant has proposed to use Selective Catalytic Reduction (SCR) as an emissions reduction technology. With the use of SCR, the NO<sub>x</sub> emissions would be reduced to two parts per million by dry volume (ppmdv) when burning natural gas. Order No. 754 at 49 (Finding of Fact No. 31). In the Second Revised Application on page 6.1-1, the NO<sub>x</sub> emissions when burning natural gas will be exactly the same--two parts per million by dry volume. There is no reduction in NO<sub>x</sub> emissions when burning natural gas, yet the applicant on that same page is claiming a 33 percent reduction in NO<sub>x</sub> emissions when burning natural gas.

3

**Q: Do you have an understanding of the basis for the applicant's assertion that there is a reduction in NO<sub>x</sub> emissions even though they are the same in the current proposal as in the proposal that was considered by the Council in Order No. 754?**

A: Yes. Rather than comparing the current proposal to the proposal that was before EFSEC in Order No. 754, the Applicant has compared the current proposal with an earlier version of the project. In its initial Application to EFSEC in 1999, the Applicant proposed a project that would have had NO<sub>x</sub> emissions at the rate of 3.5 parts per million. Later, the Applicant proposed a 3.0 emission rate. Later still, but prior to EFSEC's Order No. 754, the Applicant had proposed to reduce that to two parts per million. My understanding is that we are supposed to be comparing the current project with the project that was before EFSEC at the time Order No. 754 was entered. Using that standard, the current Application reflects no reduction in NO<sub>x</sub> emissions.

**Q. In Order No. 754, the Council found that among levels that pose potential risks to health occur in the Fraser Valley about 43 percent of the time for ground-level ozone pollution. Order No. 754 at 50 (Finding of Fact No. 38). What is the expected effect of the proposed changes on ground-level ozone in the region?**

A. If there are no daytime start-ups, there would be a small reduction. The reduction probably would not result from the elimination of diesel so much as it would from the higher stack.

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The peak seasons for ground-level ozone are summer, spring and fall. Thus, the modeling has been conducted for a representative summertime smog event. See Exhibit 25.3. The elimination of backup oil, which the Applicant argued would have been used mainly during the winter months, has no effect on the predicted ozone levels during the prime smog seasons, spring through fall. The proposed increase in stack height may provide a small decrease in the predicted ozone impacts (but no more than about 10%).

If start-ups were to occur in the daytime during smog events, they could lead to a significant increase in the predicted maximum 1-hour ozone concentrations. This would more than negate the effect of the higher stack.

4

**Q. In Order 754, the Council found that pollutants from the plant “would cause a perceptible change in visibility for at least several days per year. There would be a diminution [in] visibility at least two days a year in the Olympic National Park which is approximately 100 miles from the proposed project.” Order No. 754 at 50 (Finding of Fact No. 39). What is the effect of the changes in the proposed project on regional haze and visibility?**

A. The potential for visibility impacts in the Abbotsford area has been reduced by only a small amount, despite the elimination of backup oil firing. As part of the previous application, analyses were conducted for several sight-lines in the Abbotsford area. The results were presented in the Lower Fraser Valley Air Quality Coordinating Committee report of September, 2000. In the absence of oil firing, it was predicted that a perceptible reduction in visibility would occur on up to 14 days/year. Changes to the proposed power plant in the current application do not affect these predictions.

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Oil firing was expected to contribute only a few additional days/year of reduced visibility. Oil firing was expected to occur on only 10 days/year (maximum rolling average), of which no more than about 25% would be days when visibility is noticeably affected. This contribution from oil firing has been eliminated in the Second Revised Application, but now SO<sub>2</sub> emissions are higher when burning gas, which will partially offset the small gain achieved by eliminating oil firing.

**Q: Do you believe the modeling results provide an accurate assessment of visibility impacts?**

A: No. Like all modeling, the modeling procedure used in this analysis is approximate. In the present case, it has some shortcomings that would lead to an underestimation of the impact of the S2GF on visibility in the Abbotsford area.

- The predicted wind speeds used in the modeling were about 30% higher than actual wind speeds in the Abbotsford area. This leads to a commensurate underestimation of pollutant concentrations and their impact on visibility in that area.
- The CALPUFF model used in this analysis represents a simplified treatment of visibility and haze. It does not account for the effect of secondary organic aerosol formed as a byproduct of VOC emissions and does not account for the effect of gaseous pollutants, NO<sub>2</sub> in particular, which may lead to a

modest underestimation of the impact on visibility. It also does not fully account for the contribution to particulate matter made by  $\text{NH}_3$  emissions.

5

In addition to the above, assumptions about the chemical make-up of the particulate matter emitted by the S2GF introduce additional uncertainty to the results.

**Q: Regarding particulate matter, in Order No. 754, the Council found that the Lower Fraser Valley airshed is under active air quality management by British Columbia agencies because it is already prone to periods of poor air quality due to, among other things, inhalable particulates; that current particulate matter concentrations in the Valley exceed Canadian 24-hour criteria up to four days per year; and that the facility's particulate emissions would "add to the background concentrations and further narrow the present small margin of safety between an acceptable ambient air quality and the level at which association between level of particulate matter and increased health risks occurred." Pre-Hearing Order at 24, 25, 26-27. What are the implications of the proposed modifications as they relate to the Council's findings about particulate matter?**

**A.** The changes and related analyses provide no basis for concluding that there should be any change to the Council's previous conclusions. The Second Revised Application and the Applicant's Pre-Filed Testimony do not provide sufficient information to warrant a change in the Council's conclusions. One problem with the Applicant's materials (and I have already mentioned this in another context) is the failure of the Applicant to consider the higher  $\text{NO}_x$  and VOC emissions during start-up and shut-down. Those higher emissions can contribute to particulate matter and must be factored into a proper analysis.

6

Another weakness of the analysis is that it does not fully consider the secondary formation of particulate matter. The basic problem is that the predicted values shown in Section 6.1 of the current EFSEC application do not account for all of the  $\text{PM}_{10}$  and  $\text{PM}_{2.5}$  that will be present in the plume. The modeling accounted for the portion of the particulate matter that is emitted directly from the stacks, but did not account for particulate matter that is formed in the outside air as a byproduct of chemical reactions among other pollutants. Emissions of  $\text{NO}_x$ ,  $\text{SO}_2$ , VOC's and  $\text{NH}_3$  can all contribute to so-called "secondary" particulate matter.

Eric Hansen, in his pre-filed testimony, acknowledges this deficiency in the Second Revised Application but only provides a partial correction. Hansen uses a different model (the CALPUFF model) and generates predictions of particulate matter that are 50 percent higher than those presented in Section 6.1 of the Second Revised Application. Hansen explains that his higher results are because the CALPUFF model accounts for some of the secondary particulate matter formation. While accounting for some of the secondary particulate matter formation is a step in the right direction, CALPUFF still falls short, as mentioned previously. Without an

analysis that fully considers secondary particulate formation, it is impossible to make a substantiated claim about the revised project's impact on the "present small margin of safety" in particulate levels that is of concern to the Council.

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Moreover, as previously noted, the CALPUFF modeling had the additional shortcoming of overestimating wind speeds in the Abbotsford area, which would lead to an underestimate of maximum ground-level concentrations. Taking these factors, into consideration, the overall concentration of particulate matter could be significantly more than suggested by Mr. Hansen.

**Q: In Order No. 754, the Council found that the "Canadian portion of the Lower Fraser Valley would receive much of the potentially harmful air emissions from the proposed power plant." What are the implications of the current modifications to that finding?**

**A:** None of the changes in the Second Revised Application would cause any change in that conclusion. The only change that would remotely have the potential to affect that finding would be the change in the stack height. But in terms of regional dispersion, there is no significant difference between the emissions occurring 150 feet above the ground versus 180 feet above the ground. Either way, the Canadian portion of the Lower Fraser Valley would receive much of the potentially harmful air emissions from the proposed power plant.

7

**Q: In Order No. 754, the Council found that "the Lower Fraser Valley in Canada is a confined airshed where mountains act to confine the air mass and the topographic features exacerbate the retention of pollutants." Order No. 754 at 51 (Finding of Fact 42). Do any of the project changes or new information in the Second Revised Application impact that finding?**

**A:** The most obvious change that might have had an impact that way would be a change of location. That is, if the modification of the project were a new site in an area with more favorable air quality conditions. None of the modifications proposed in the Second Revised Application have any impact on the fundamental problem identified in Order No. 754 that this polluted, confined, highly populated, and rapidly growing area is not an appropriate site in which to locate a power plant.

### **END OF TESTIMONY**

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BEFORE THE STATE OF WASHINGTON  
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION  
FACILITY

Exhibit \_\_\_\_\_ (RAD-T)

PRE-FILED TESTIMONY OF  
R. ALLAN DAKIN

**Q: Please state your name and business address.**

A: Allan Dakin, Piteau Associates Engineering Ltd., North Vancouver, British Columbia.

**Q: What subjects do you intend to address in your testimony?**

A: Impacts of the proposed increased well field pumping on water supplies and stream flow in British Columbia.

**Q: What is your position with Piteau Associates Engineering Limited?**

A: I am a Senior Groundwater Engineer and Vice President of hydrogeology. My resume is attached as Exhibit \_\_\_\_ (RAD-1).

**Q: Could you describe your background and experience?**

A: I graduated as a civil engineer in 1965 and gained my M.Sc. in hydrogeology in 1976. Over the past 31 years I have been working as a groundwater consultant on a wide range of projects in Canada and abroad. These projects have included groundwater supply, protection of aquifers, contaminant migration and impact assessment of well field operation on base flows in streams. Projects located close to the Sumas well field include: an assessment of storm water infiltration into an area that overlies the Abbotsford Aquifer, a water balance assessment of the Aldergrove Aquifer (west of the Abbotsford Aquifer) and a review of the Abbotsford Trout Hatchery well field operation (north of Sumas).

**Q: In preparation for this hearing, what documents did you review?**

A: I have read the documents that relate to groundwater that have been posted on the EFSEC web site, a number of reports prepared by Robinson & Noble, Inc. on the Sumas well field capacity, the Associated Earth Sciences, Inc. report on the City of Sumas wellhead protection plan, the US Geological Survey's LENS groundwater

study, the testimony of Burt Clothier submitted during the first hearings, and the pre-filed testimony of Burt Clothier filed in September, 2001. I have also recently re-read portions of BC Environment and Environment Canada's studies of the Abbotsford Aquifer.

**Q: In Order 754, the Council noted that the FEIS concluded that "the large volume of groundwater that would be extracted from the Sumas City well fields to supply the plant would result in increased drawdown in the areas surrounding the well fields" and that this would "in effect, be a permanent condition because the well fields would be pumped continuously." Order No. 754 at 31-32. Did SE2 make any changes that potentially impact these findings?**

**A:** Yes. SE2 has reduced its peak and average water demands. This means that it will be withdrawing less water from the aquifer (via the city of Sumas' wells). However, the reduction is only slight. For instance, annual usage (maximum) is projected to decline from 1053 acre-feet/year to 1025 acre-feet/per year. Ex. 181.3 (Second Rev. Application) at 2.5-1.

**Q: Does the current application include any new analysis of groundwater impacts associated with this slight reduction?**

**A:** No.

**Q: Last time, the Council noted that the FEIS concluded that "there is not sufficient hydrogeologic information available to determine how much the additional drawdown would be in any particular location or whether any existing well uses would be affected." (Order No. 754 at 32.) The Council noted that an applicant has a duty to provide "detailed descriptions" of "project impacts" and concluded that "the Application has not fully evaluated the impacts of large amounts of groundwater withdrawal on wells located within the cone of influence." (Id.) Based on the changes made by SE2 in its revised application, is there any basis for the Council to modify those conclusions?**

**A:** No. As I mentioned, there has been no new analysis and the need for an adequate analysis is just as great whether the withdrawal is 1025 or 1053 acre-feet/year.

**Q: Is this a concern for the Province of British Columbia?**

**A:** Yes. The aquifer pump tests carried out to date have shown that the well fields will have a relatively significant impact on wells located a long way from the well field into British Columbia. The nearest well in British Columbia is likely less than 1,500 feet from the well field. The City of Sumas' groundwater specialist (Robinson & Noble, Inc.) has provided preliminary information that shows a well

located as far as 5,500 feet from the well field could experience one foot of drawdown when the well fields are in operation. See Figure 1 (Exhibit \_\_\_\_ (RAD-2)). As there are many wells located in British Columbia that lie within this extensive cone of influence, there is justifiable concern that yields from some of the shallower wells in British Columbia may diminish and/or completely dry up.

1

**Q: The FEIS states that the groundwater withdrawals for SE2 could reduce baseflow in local streams (FEIS at 3.2-26). How is that possible?**

A: There is a connection between groundwater and surface water flows in this area. There is a sand and gravel aquifer (presumably Sumas outwash) at a depth of about 45 feet below the well field sites. This groundwater flows southeast and then eastward and eventually flows back to ground surface. Most of this groundwater is discharged into the Sumas River and its many tributaries, such as Johnson Creek (located near the May Road Well Field).

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Both the City of Sumas and May Road Well Fields pump water from this sand and gravel aquifer and thereby intercept water that would otherwise replenish surface flows in the Sumas River and its tributaries. Figure 2 (Exhibit \_\_\_\_ (RAD-3)) is a conceptual flow system drawing depicting this phenomenon. When the May Road wells were aquifer pump tested, it was possible to confirm that there was a reduction of flow from a nearby spring that discharged into Johnson Creek.

**Q: Given that relationship, how might the withdrawal of large quantities of groundwater for the project impact surface water flows?**

A: SE2's proposed withdrawals from this aquifer are very large in comparison to the City's existing withdrawals. There is a clear potential for those withdrawals to decrease surface water flows in the Sumas River and its tributaries.

**Q: Could these impacts be felt in Canada?**

A: Yes. The decrease in flows would occur in the Sumas River system just upstream of where the Sumas River flows into Canada.

**Q: What are the implications of the changes SE2 has made in its Second Revised Application as it relates to this potential impact to the Sumas River flowing into British Columbia?**

A: It's impossible to assess the implications quantitatively because the application does not quantify base flow in the Sumas drainage area and the impact of well field pumping on surface water flow has not been addressed. However, assessing the implications qualitatively, I think it is safe to say that given the relatively slight reduction in groundwater withdrawal reflected in the revised application, there

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would be very little difference in the impact on base flows in local streams. The magnitude of that impact remains unassessed.

**Q: SE2 has amended its application to include a proposal to monitor groundwater levels before and after its withdrawals begin. Do you consider this proposal an adequate response to the groundwater and surface water issues you have been discussing?**

2

**A:** No, and for several reasons. Let me address the surface water issue first because it is the easiest. The monitoring proposal makes no reference to monitoring surface water levels or groundwater levels near where the aquifers feed back into surface water. The monitoring program doesn't address the surface water issue at all.

Moreover, even if it did, it's not clear what sort of remedial action would be practical if the monitoring program disclosed a problem with recharge of surface waters. It's not enough to propose monitoring if it's not accompanied by some realistic approach to addressing any problems identified during the monitoring.

**Q: What about the adequacy of the monitoring program as it relates to groundwater?**

**A:** The monitoring program is aimed at evaluating the impacts of the withdrawals on groundwater, but it is incomplete in several respects. SE2 has proposed to survey some wells that are located within the projected drawdown cone. SE2 also proposes to install dedicated monitoring wells and measure the water level response during the controlled test of the well fields prior to the commencement of the plant operation. This information apparently will be used to assess potential impacts. The first problem is that SE2 has not stated which wells in British Columbia will be included in the monitoring program. It is vital that all wells in British Columbia within the cone of influence be included in the monitoring program.

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Second, there is also a problem of timing. It is only after the first year of operation that there is provision for SE2 to submit for the Council's approval a mitigation plan to replace lost well production capacity and prevent further loss. In my opinion, the impact of the pumping will become apparent within a month of the commencement of full scale pumping from the well field and there is no need to wait a year to carry out the assessment.

Third, SE2 has not provided any details of either the proposed monitoring program (e.g. frequency of monitoring and water quality parameters etc.) or their mitigation plan for the period leading up to the end of the first 12 months of operation in British Columbia.

I believe that the details of the entire monitoring and mitigation plan should be specified now, to be sure that SE2 will adequately address British Columbia's concerns.

3

**Q: In Order No. 754, the Council noted that the Applicant did not know whether the withdrawals for its facility would accelerate the transport of nitrates to the Sumas portion of the aquifer and expressed its concern that "no mitigation has been identified if the increased pumping from the City well fields results in nitrate exceedances in the wells of those residents who do not use City water." Order No. 754 at 32. The Council found that the Applicant "did not bear its burden to describe the means to be used to mitigate such adverse impacts on other people's water supply." *Id.* What are the implications of the changes SE2 proposes as they relate to the potential nitrate contamination of private wells?**

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**A:** Again, it's difficult to assess the implications because the basic analysis has not yet been completed for either the original application or the current one. That is, the Applicant has not made any effort to evaluate the potential nitrate problem in individual wells in British Columbia and so assessing the implications of the recent project modifications as they relate to this issue can only be done subjectively.

With that understanding, I think it's fair to say that it is unlikely that the slight reduction in water withdrawals contemplated by the recent revised application will have any significant effect on the nitrate problem. Whatever that problem was before the modifications, it likely remains the same now. Further, given that there's no change in that assessment, there remains a need for a mitigation plan for those private wells. But the revised application does not propose anything new in that regard. Thus, the Council's statements you just quoted remain valid for this revised proposal. The implications of the recent project modifications are nil.

**END OF TESTIMONY**

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BEFORE THE STATE OF WASHINGTON  
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION  
FACILITY

EXHIBIT \_\_\_\_ (RBC-T)  
PRE-FILED TESTIMONY OF  
ROBERT B. CATON

**Q: Please introduce yourself.**

A: My name is Robert Caton.

**Q: What subjects do you intend to address?**

A: I will address issues related to the project's air pollution emissions and impacts.

**Q: What is your background to address such issues?**

A: I hold a Ph.D. in physical chemistry and for the past 21 years have been involved directly in consulting for public and private sector clients on emissions and air quality matters. I hold the designation Qualified Environmental Professional (QEP) from the Institute of Professional Environmental Practice. In recent years, my practice has been primarily in the areas of air quality management analysis and strategic planning and in corporate environmental management systems development.

I have been employed with consulting companies that have carried out analysis of emissions and air quality in the Lower Fraser Valley since the early 1980s, and my personal involvement in analysis and assessment of emissions and air quality in the region dates from 1988-9 when I chaired the scientific advisory panel for the first stage of development of the current Air Quality Management Plan for the Greater Vancouver Regional District (GVRD). Subsequently, I have directed a number of studies in support of the development of the final AQMP (1994) and its implementation since then. I have directed or participated in a variety of technical analyses and policy and strategy development studies in the region for GVRD, the Province of British Columbia, Environment Canada and a variety of private sector clients in the energy and manufacturing sectors. This body of work includes air quality analysis, cost-benefit analysis of emission reduction measures, impact assessments of specific pollutants (e.g., PM10, diesel particulate matter, hazardous air pollutants) and strategic planning.

Nationally in Canada, I served as a member of the Atmospheric Science Expert Panel for the Joint Industry/Government-sponsored Study of Sulfur in Gasoline and Diesel Fuels (1997). Recently, I assisted the Analysis and Modelling Group in the Canadian National Climate Change Process to carry out analysis of the air quality and other environmental co-benefits of measures to mitigate climate change (2000-2001). Since 1980, I have appeared as an expert witness on emissions and air quality issues in various quasi-judicial processes in the provinces of Ontario, Alberta and British Columbia, and federally.

For more than 25 years I have directed or participated in multi-disciplinary research and project work in which I have coordinated teams and integrated information on emissions, air quality modelling and analysis, health effects and other environmental impacts, risk analysis and economic valuation of effects.

**Q: Could you please summarize your conclusions?**

**A:** Yes, but let me preface that by saying that all of my remarks are intended to refer to the changes between (1) the project documentation and hearing record of the original EFSEC hearing that led to its decision as recorded in Order #754 and (2) the June 29, 2001 Second Revised Application and its supporting documents that are before us now. In that context, I intend to comment on the following issues:

1. There is no new information in the amended application or otherwise that would suggest that there is need for any change in the Council's conclusions about the impaired air quality in the Lower Fraser Valley airshed. The Council's conclusions in that regard should not change.

2. The project modifications in the Second Revised Application cause little reduction in projected emissions from the facility and little reduction in the resulting air quality impacts. There are several sub-points here:

- The annual emissions of the pollutants of greatest concern in this case, particulates (soot) and NO<sub>x</sub> (an ozone precursor) would drop by only six percent and seven percent, respectively B and perhaps even less if start ups and shut downs are taken into account. That small of a drop should have very little effect on the Council's air quality conclusions.
- The applicant is wrong in claiming that the current proposal to emit NO<sub>x</sub> at a rate of two parts per million represents a 33 percent reduction from the project considered by the Council in Order No. 754. The emission rate for NO<sub>x</sub> now and the emission rate considered by the Council in its prior recommendation are precisely the same B two ppm. There has been no reduction in that emission rate.

- Looking at the combination of all emissions of all pollutants on an annual basis, the revised proposal will probably emit slightly less than the prior proposal. How much less is a function of the frequency of start-ups and shut downs. Ignoring that factor for the moment, the annual emissions from the revised project will be about 16 percent less than the one described in Council Order No. 754.
  - The applicant makes claims of much larger percentage reductions by looking at short-term emission peaks (instead of annual emissions). The applicant's analysis of short-term peaks is flawed in several respects. One, the applicant presents a false comparison. Ostensibly, the applicant is comparing worst case, short-term emissions under the former proposal with worse case, short-term emissions under the current proposal. But in fact, the applicant has ignored worst case, short-term emissions under the current proposal by ignoring emissions during start-up and shutdown. Start-up and shutdown operations could occur more often under the current proposal than diesel would have been burned under the old proposal. Peaks associated with start up and shut down cannot be ignored. No valid claim of a reduction in short-term peaks can be made without that information.
  - The Applicant is wrong to suggest that, from a public health perspective, the focus should be on short-term air quality impacts. Long-term exposures to air pollution at levels below peaks is a significant health concern. That's part of the reason air quality standards are written for both long and short-term exposures. In fact, the health assessment done by the three Canadian agencies last year for this facility (the "Joint Technical Report," Exhibit 162.12) focused on the long-term exposures as being the most problematic from a health risk perspective.
  - The applicant's focus on short-term emissions ignores that annual emissions are reduced only slightly and, in fact, in some instances actually increase. For instance, annual emissions of sulfur dioxide are estimated to increase by 50 percent to 69 tons per year and sulfuric acid mist emissions by the same percentage to 14.3 tons per year.
3. The modifications in the project will have little impact on the prior health effects analysis.
- A health effects analysis has to consider impacts from both long-term (annual) exposures and short-term (peak) exposures.

- Because there is little change in the annual air pollution emissions from the facility, there is little change in the health impacts associated with those annual emissions.
- Because the applicant has not presented a valid comparison of the change in short-term emissions, it is impossible to reach any meaningful conclusions about how a potential change to short-term emission would impact the health effects conclusions.
- Most of the health effects testimony presented by the applicant re-hashes the earlier debate about whether adverse health effects occur even when minimum regulatory standards are met. That testimony does not seem to respect the limited scope of this hearing.
- Health studies published since the close of the first round of hearings support the Council's conclusion that significant health effects do occur at levels below the minimum regulatory standards.
- The increases in air pollution caused by SE2's omissions will result in adverse health effects.

4. SE2's offset proposal is flawed in several respects:

- The Province has made substantial strides towards improving air quality in this region but more improvement is needed; the air is still unhealthy. Efforts to reduce or eliminate air pollution emissions from existing sources should not be traded for new emissions which are not necessary to occur in this air shed. Simply trading old emissions for new ones will not advance the Province's goal of improving air quality in this highly populated region.
- The offset proposal is technically flawed, too. There do not appear to be large emission sources close to the SE2 site that could serve as appropriate offsets.

The 1.5 million mitigation fee offered to be paid in lieu of an offset program is not adequate. It will not create benefits for those who would be breathing SE2's pollution and the dollar amount is insubstantial considering the expense incurred by the Province in pursuing other air pollution abatement efforts.

5. I will also respond to a number of collateral points raised in the testimony of Mr. Martin and Mr. Hansen.

**Q: Let's start with existing air quality in the Lower Fraser Valley. Are you familiar with the Council's finding on that issue in Order No. 754?**

A: Yes.

**Q: Have you assessed whether there is new information in the Second Revised Application which would cause a change in the Council's findings regarding that matter?**

A: Yes, I have made that assessment. In so doing, I want to emphasize that I focused on new information and developments that would supplement EFSEC's understanding of the evidence on air quality and its impacts, rather than revisit old ground. I believe that this is consistent with the limited scope of these resumed hearings, as established by EFSEC.

**Q: What conclusions did you reach as a result of that review?**

A: Let me start with the airshed and then move to the project. The Second Revised Application presents new monitoring data from 1999 for the Lower Fraser Valley airshed that was not presented at the last hearing. Given the limited scope of this hearing, the issue here is whether that data suggests any changes are needed in the Council's prior findings about the airshed. The Council's prior findings were, and I quote EFSEC's decision: "[c]onsistent evidence from highly qualified expert witnesses indicates that the Lower Fraser Valley is already an environmentally sensitive area with acknowledged atmospheric visibility problems and is already considered to be an impaired airshed." Council Order No. 754 at 23. Further, the Council cited and quoted other evidence that "the Fraser Valley airshed is very sensitive and already suffers from significant air quality and visibility issues;" that the airshed is "under active air quality management by British Columbia agencies . . . because it is already prone to periods of poor air quality, including elevated levels of ground-level ozone, inhalable particulate and visibility reductions;" that the Lower Fraser Valley "already exceeds current ambient air quality objectives for ozone;" that "air quality in the Lower Fraser Valley . . . and many other parts of British Columbia is frequently in the range where its effects upon health have been demonstrated;" and that "various short- and medium-term air quality objectives and standards for the area from Hope to West Vancouver are already exceeded up to ten percent of the time." Council Order No. 754 at 24. Finding of Fact No. 38 also includes additional details about air quality in the Lower Fraser Valley. Nothing has changed since the issuance of Order No. 754 to change the basis for any of those conclusions.

In particular, I am very familiar with the air quality monitoring database for the Lower Fraser Valley and conclude that the new data for 1999 presented in the Second Revised Application do not change the picture presented in the previous Application. For example, Table 6.1-8 in the SRA shows that the monitoring data for 1999 do not show any improvement for the critical pollutants NO<sub>x</sub>, ozone and PM (both PM<sub>10</sub> and PM<sub>2.5</sub>). That is, the average maximum values over the period

shown in the table for these pollutants are not materially different from the comparable values shown in the previous Application. Moreover, based on my observations of GVRD's ongoing air quality reporting, I expect that air quality data for the region for 2000 would show little change from the period analyzed by the Applicant's consultants. The Council's conclusion that the airshed is suffering from too much pollution is still sound.

3

**Q: Eric Hansen testifies in this second round of hearings that air quality in the Fraser Valley is "very good" at least by United States standards. Ex. 182 at 17:17 (Hansen). Is his testimony in that regard based on any new evidence that was not available at last year's hearing?**

**A:** No. Hansen gave essentially the same testimony last year. His optimistic characterization of air quality in the region was rejected by EFSEC: "Although the Applicant argues that the Lower Fraser Valley airshed is not a particularly threatened, impaired, or sensitive airshed, the Council finds the evidence to the contrary is not only convincing, it is overwhelming." Order No. 754 at 23. Hansen does not cite any new monitoring data or other evidence to support changing EFSEC's previous conclusions. Just because air quality in Abbotsford (and the Canadian Lower Fraser Valley, generally) has neither improved nor deteriorated in recent years does not mean that it can be classified "very good."

**Q: Then let's shift from characterization of the airshed to the project. How do the proposed project changes affect air pollution emissions?**

**A:** Very little. As explained in more detail in Michael Lepage's testimony comparing the current proposal to the former proposal, the annual emissions of particulates (soot) and NO<sub>x</sub> (an ozone precursor) would drop by six percent and seven percent, respectively (and perhaps even increase if start-ups and shut-downs are considered). That small of a drop should have very little effect on the Council's conclusions. Last time, the Council concluded that the facility's emissions would be "indisputably a large amount of pollution to add to an airshed." Order No. 754 at 20. A six or seven percent reduction in the two pollutants of greatest concern should not change that fundamental conclusion.

4

**Q: The Second Revised Application and the Applicant's Pre-Filed Testimony refers to much larger percentage reductions in emissions. Are those statements in error?**

**A:** In a sense, yes. As one example, the claimed reduction in NO<sub>x</sub> of 33% was already part of the record on which EFSEC based its original decision not to approve the project. The lowering of the operating NO<sub>x</sub> level from 3 ppm to 2 ppm was in the draft PSD permit (Ex. 170.1 at 6:134); it was used as the basis for the Joint Technical Report (Exhibit 162.12 at i and 8); and it was used as a part of the project

description by EFSEC in its original recommendation. Order No. 754 made express reference to the 2 ppm emission rate for NO<sub>x</sub>. Council Order No. 754 at 49 (Finding No. 31). The inclusion of a 2 ppm emission rate in the Second Revised Application is not a real change in the project description.

**Q: Are there other problems with the Applicant's focus on the claimed reduction in peak emissions?**

A: Yes. One additional problem is that the Applicant focuses on peak emissions without acknowledging that even though peaks are reduced, total emissions can still go up. For instance, even though SO<sub>2</sub> and sulfuric acid mist peaks have been reduced, the annual emissions of those pollutants has increased significantly. Annual emissions of SO<sub>2</sub> are estimated to increase from 45 tpy to 69 tpy, and sulfuric acid mist from 7.9 to 14.3 tpy.

**Q: What is the cause of the increase in SO<sub>2</sub> and sulfuric acid emissions?**

A: The discrepancy is due to an erroneous value for the sulfur content of pipeline gas in the earlier (first) Revised Application. Because of that error, the emissions of sulfur dioxide and sulfuric acid mist under normal conditions actually increase by about a factor of five. This increase exceeds the reductions of sulfur oxides associated with removing oil firing, leading to a substantial net increase. Both of these pollutants will also add materially to the ambient PM10 or PM2.5 loadings through formation of secondary particulate matter. The original error in estimating sulfur oxide emissions is not even acknowledged in Hansen's testimony. One has to read the Second Revised Application in detail to find it in the PSD analysis. Exhibit 181.3 at 6.1-1 & 6.1-2.

**Q: Is the increase in SO<sub>2</sub> and sulfuric acid mist a concern? We have not heard much about these pollutants in the earlier proceedings.**

A: The increase in SO<sub>2</sub> and sulfuric acid mist would lead to the production of additional fine particulates and thus would negate most of the apparent reduction in particulate emissions stated in the Second Revised Application. The sulfuric acid mist in particular would react rapidly with the ammonia already in the plume from SE2 (even at the lower estimated emission rate in the SRA) and with the ample ambient ammonia in the Fraser Valley air from agricultural sources to form ammonium sulphate. The ammonium sulphate would add directly to the fine particle loading. These fine particles would all be in the PM2.5 size range that is of greatest concern respecting both public health and visibility impairment. Mr. Lepage addresses this technical issue in his pre-filed testimony.

**Q: Are there more problems with the Applicant's focus on the peak emissions?**

A: Yes. The Applicant claims that there are huge reductions in peak emissions as a result of eliminating the use of diesel. But the applicant presents a false comparison. The comparison ought to be between the peak emissions for the prior proposal and the peak emissions for the current proposal. To make that comparison, one obviously needs to identify the peak emissions for the current proposal. But the applicant has not done this. As Mr. Lepage describes in greater detail, the peak emissions for the current proposal would occur during start-up and shut-down. The amount of time starting up and shutting down can be two or three times more than was proposed to be spent burning diesel fuel under the prior proposal. Yet the Applicant never submits information about the emission levels during these potentially extensive periods of starting up and shutting down. Without that information, it is impossible for the Applicant to make any claim about how much peak emissions have been reduced as a result of the project changes. EFSEC noted this deficiency in Order No. 754 [at page 21, footnote 29], but the Applicant has not responded to it in the SRA. Michael Lepage provides some estimates of start-up and shut-down emissions in his testimony.

4

**Q: If it is impossible to make that comparison based on the data presented by the Applicant, how did the Applicant develop those large percentages?**

A: The Applicant takes the worst-case peaks from the old proposal and compares them to the best case operating conditions for the new proposal. Little wonder that in comparing worst case to best case they are able to develop percentages that, at first blush, appear very impressive.

**Q: Are there any other concerns you have about the Applicant's focus on short-term, peak emissions?**

A: Yes. The Applicant suggests that it is appropriate to focus on peak emissions because those are the ones that create the primary health and visibility concerns. But there are several things to consider here.

First, on close examination, I notice that Mr. Hansen does not himself testify that he believes that annual emissions or annual average impacts are worthy of less attention than peak emissions and peak impacts. Rather, he states that peak emissions were the focus of the first round of hearings. Exhibit 182 at 4:19-35. There is a reason that air regulations and studies on air quality health effects look not just at peak conditions but also long-term ambient conditions. Both perspectives play an important role in any discussion of air quality impacts.

Second, while I did not participate in the first round of hearings, I have reviewed the portions of the record dealing with air quality. While certainly the use of diesel for a maximum of ten days per year (on average) made the situation that much worse, it is clear that the parties and the Council were not focused exclusively on

that component of the project. For example, Environment Canada's ozone modeling estimates do not use the oil-firing peak emissions.

Similarly, in the PM Health Impact Assessment (Section 4.4.4 of the Joint Technical Report, 2000), Exhibit 162.12, the health effects estimates and valuation are essentially unaffected by the newly-estimated emissions, since they are dominated by the longer-term elevation of ambient concentrations of PM, not by the peaks associated with oil-firing. In fact, the oil-firing emission peaks did not contribute materially in the health impacts assessment in the Canadian Joint Technical Report (Exhibit 162.12 at 24, Tables 10 & 11), since the typical emissions from the other 350 days of normal operations dominate the health effects assessment. Since the total contribution of the SE2 emissions to ambient PM loadings will not be changed materially by the revisions shown in the Second Revised Application, there would be no material change to the estimates of the health impacts and their valuation.

**Q: What are the health effects implications of the changes in the project?**

**A:** The changes in the project should have very little impact on this Council's conclusions regarding the health risks associated with this project. There are five principal points to make in this regard.

First, health risks are directly correlated to the project's emissions and, as I have discussed and as Mr. Lepage details, the project changes will result in very little change in overall emission rates. The project modifications represent virtually no change in long-term emission rates and therefore virtually no change in health effects associated with long-term exposure. Short-term exposure health effects may be different but it is impossible to evaluate that because the Applicant has failed to produce information about short-term emission peaks.

Second, the majority of the health effects information provided by the Applicant in this round of the proceedings is contained in the Pre-Filed Testimony of Sanya Petrovic. However, it does not appear that Ms. Petrovic has confined her comments to correspond to the limited scope of these proceedings. In Council Order No. 754, the Council rejected the Applicant's claim that compliance with regulatory standards could be equated with an absence of health effects. Rather, the Council quoted with approval the portion of the Canadian "Joint Technical Report" (Exhibit 162.12) which states that "recent studies on air quality and health indicate that effects on human health begin to occur at levels well below any of those [government] objectives and standards." Council Order No. 754 at 24.

Much of Ms. Petrovic's testimony is an effort to re-argue that issue which EFSEC has already decided. Ms. Petrovic does not cite anything different about the project nor any recent health studies to support re-opening that discussion. Rather, she

makes the same arguments that the Applicant made last time -- arguments the Council did not accept.

**Q: Could you elaborate on that point, please?**

A: Yes. My understanding is that the Council has limited the scope of these hearings to a discussion of the "implications of the modifications" in the proposal. As a result, I have focused my study on the changes in the project as they relate to air quality emissions and the health effects associated with those emissions. Dr. Bates has cited new health studies that have been published since Council Order 754 that are relevant to the health effects issue. But we have not gone back and re-assessed the entire health effects issue as if the first round of hearings had never happened and as if Council Order No. 754 had not been entered.

In contrast, Ms. Petrovic does not seem to have been made aware of that limitation in scope. Her testimony repeatedly re-argues issues that were debated and resolved in the initial round of hearings.

**Q: Can you give me some particulars?**

A: Yes. As I said, much of Ms. Petrovic's testimony involves an effort to justify assessing the project's health effects by comparison only to United States and Canadian regulatory standards and objectives. This testimony is an effort to avoid consideration of adverse health effects that occur even when regulatory standards are being met.

But this issue was extensively debated in the prior proceeding and the Council has already ruled on it. In Council Order 754 (at 22), the Council stated:

Although the Council concludes that the project meets federal and state air quality standards, this is the beginning, not the end, of our inquiry. Compliance with promulgated numerical air quality standards is a minimum requirement for allowing a power generating facility to be constructed in this state. The Council has a much broader mandate than simply deciding whether minimum standards are met; rather, the Council is charged with protecting the people's health and welfare and with siting power plants only where *minimal adverse effects on the environment can be achieved* . . . A power plant may satisfy the numerical standards for the amount of air pollutants that it emits without the requested site being an appropriate location.

Given that prior finding of the Council and the Council's Order limiting the scope of this hearing, much of Ms. Petrovic's testimony seems beyond the limited scope of this hearing. At page 6, line 23, she identifies as one of her two major points that

SE2 emissions will not exceed Canada-Wide Standards or the British Columbia Objective for PM10. Later on that page, she describes the Canadian air quality objective/standards as "the most relevant" and then spends nine pages discussing that topic (pages 7 through 15) and spends five more pages (16 through 20) arguing that no heed should be paid to the more protective health reference levels. She brings no new scientific information to bear on any of this discussion. She does not cite a single article or health study published subsequent to Council Order 754. Rather, she primarily makes reference to exhibits and reports that were before the Council at the previous hearings.

**Q: What is your third point regarding health effects?**

A: Ms. Petrovic's discussion of the applicability of the Canada-Wide Standards and Reference Levels ignores the "keeping clean areas clean" requirement expressed in Annex A to the Canada-Wide Standards for PM and Ozone ("Guidance for Continuous Improvement and Keeping Clean Areas Clean Programs for PM and Ozone") Exhibit 159.4. The drafters of the CWS and all of the signatories intended that areas that are now in compliance with the CWS should take steps to ensure future compliance, in fact to ensure continuous improvement in air quality. The ability of the Province to make continuous improvement is threatened by the SE2 project which, I understand, need not be sited in this airshed.

**Q: What is your fourth point?**

A: The fourth item, as Dr. Bates testifies, is that now there is even more evidence supporting the health effects conclusions addressed by the Council in Order No. 754. Subsequent to the earlier EFSEC hearings, there have been additional studies confirming the adverse effects of several air pollutants at levels below current standards or guidelines. Effects of PM and ozone especially on the elderly, children and asthmatics of all ages have been confirmed by unassailable analysis as described in the testimony of David Bates. The real issue is one of acceptable risk, not whether certain bright lines have been crossed or would be crossed if SE2 proceeds. Any amount of additional pollution increases the risk of occurrence of many respiratory and cardiac diseases. There has been no showing of thresholds below which impacts do not occur.

**Q: What is your fifth point related to the health impacts?**

A: The last point regards Ms. Petrovic's statement that because the increases in particulate matter and ozone from the SE2 facility will be a small fraction of current background concentrations that there will be no adverse health impacts from those emissions. (Exhibit 183 at 6:20-29). She elaborates on this briefly near the end of her testimony at pages 21-22. But then she contradicts herself when she claims that any reduction in air pollution (because of offsets) will have a positive effect on

human health. If any reduction in pollution equates to a human health benefit (and she is right about that), then any increase in air pollution must equate to a human health risk. She can't have it both ways.

5

**Q: Let's turn to the offset issue. SE2's witnesses have referred to an offset proposal as a way to mitigate air pollution impacts on the Lower Fraser Valley. Have you reviewed that offset plan?**

**A:** I have read the material in the Second Revised Application and in Mr. Martin's and Mr. Hansen's pre-filed testimony, but I find no explicit plan that could be evaluated at this time. As I understand the situation, SE2 has offered to submit a plan at a later date. Without seeing the plan, it is impossible to assess fully its effectiveness or acceptability.

6

**Q: Do you think it is likely that an offset plan could be developed that would address the Province's air quality concerns in this airshed?**

**A:** I think it unlikely, but the reason for that involves several issues and some background about how air quality concerns are being addressed in British Columbia.

First, the context for this discussion includes an understanding of regional air quality trends. I will detail this in a moment but, in general terms, as the result of aggressive government action, we have been successful in reducing air pollution on our side of the border. However, air pollution is still at an unacceptable level. Moreover, the relatively "easy" (most cost effective) methods for reducing emissions pretty much have been exhausted. As inevitable growth occurs in the future, it will be more and more difficult to obtain further reductions in the airshed's pollution levels or even to maintain the status quo. Despite the aggressive efforts that have brought us some success to date, the long-term trends are not good. I will explain how this relates to the offset issue in a moment, but first let me provide some more detail about these trends.

Environment Canada and GVRD have been monitoring PM10 levels in the Lower Fraser Valley since 1984. GVRD now has thirteen PM10 monitoring sites across the LFV, with continuous monitoring starting in 1994. The air quality data since 1985 show, for example, that the annual mean fine particle (PM10) concentration has declined by almost a factor of 3 between 1985 and 2000 -- from about 30 micrograms per cubic meter to about 12 micrograms per cubic meter. Monitored PM10 levels are essentially the same all across the airshed - both in terms of average concentration and statistical distributions at the 13 sites.

Similarly, monitored levels of carbon monoxide, sulfur dioxide and nitrogen dioxide have declined over the past 15 years. Ozone peak levels have declined since

the 1980s, but mean levels have been increasing slowly since the mid-1990s. Nonetheless, as I mentioned above and as the Council recognized in its prior order, despite these improvements, air quality still stands at undesirable levels.

**Q: What are the forecasts for air pollution trends in the coming years?**

A: I have recently co-authored a report for GVRD and the Province of British Columbia that sets the stage for future additional emission reductions of common air contaminants and coordinated measures to manage greenhouse gas emissions and common air contaminants. Forecasts of future air quality *based on* the anticipated changes to the Canadian Lower Fraser Valley emission inventory attributable to anticipated changes in existing sources indicate that current air quality will persist for the next 5 or 10 years as continuing emission reductions in some sectors are just about balanced by increasing emissions associated with regional population and economic growth. Between the 2005-2010 time period and 2020, emissions of some pollutants in the Canadian Lower Fraser Valley are predicted to increase slowly, even with no new industrial sources accounted for. Projections of the concentrations of CO, SO<sub>2</sub>, NO<sub>2</sub> and PM<sub>10</sub> based on the best currently available emission inventories (that take into account all of the anticipated future improvements in on-road vehicle emissions) show that although CO, SO<sub>2</sub> and NO<sub>2</sub> concentrations are expected to decrease, PM<sub>100</sub> levels will rise slowly between 2005-2010 and 2020. The forecast trends take into account all of the emission reduction measures in the 1994 GVRD Air Quality Management Plan, as well as anticipated changes in response to other committed regulations. By 2020, I estimate that the average PM<sub>10</sub> level in the Lower Fraser Valley will have increased by about 15% from current levels (including contributions from both primary emissions and secondary pollutant formation). Again, this projection assumes that there are no new industrial sources added to the inventory.

An important point is that the trend toward reduced emissions and improved air quality over the period 1985-1999, which has plateaued over the past five years or so, has been the result of considerable effort and commitment by regulators and stakeholders and has cost a significant amount of capital investment. Even with all of the effort and investment, air quality improvement in the region has slowed or stopped - leaving current air quality at undesirable levels.

**Q: Now that you've described these trends, please explain how they influence the development of an offset program?**

A: The measures that have been implemented in the Canadian Lower Fraser Valley since the 1980s have focused on the most cost-effective measures first. These measures have achieved marked reductions in emissions of most pollutants between 1985 and 1995 (PM being the principal exception). Additional emission reductions will be necessary to maintain and improve air quality in the future but the necessary

measures have been assessed to be relatively more expensive and will be harder to achieve. Remaining opportunities for emissions reductions will have to be carefully managed to compensate for unavoidable increases in emissions that accompany regional growth. It would not be wise to use those potential emission reductions to offset new pollution sources that do not need to be sited in this vulnerable airshed. This factor alone suggests offsets should not be used to justify a major new emission source which is not necessary to be sited in this particular airshed.

**Q: Do you have any information regarding the air quality impacts of this plant when considered in conjunction with other proposed power plants in this region?**

A: Yes. I was reviewing a recent air quality report sponsored by the Bonneville Power Administration (BPA) which sheds some light on this issue. Interestingly, the report [ "Phase I Results, Regional Air Quality Modeling Study," Bonneville Power Administration, August 1, 2001] was carried out by SE2's air quality consultants, MFG. The report states that there are about 45 proposed power plants lined up for potential approval in Oregon and Washington and that, if all were built, they would create a significant cumulative impact on regional air quality in the Northwest United States and British Columbia. Of note is that the report states that of the 45 planned plants (representing more than 24,000 MW), "it is highly unlikely that more than 6,000 to 8,000 MW will be built." That is, only one-quarter to one-third will be viable. It would appear that an EFSEC decision to respect the Province's concerns about siting this plant at this particular location doesn't represent a constraint on future energy, given the number of proposals available.

**Q: In addition to these fundamental policy concerns about an offset program, are there any practical obstacles to using offsets in this particular setting?**

A: Yes, there are practical problems, too. The practical problems relate to both location and timing. Because of the complex nature of pollutant movement and chemical transformation in the Lower Fraser Valley airshed, the specific location of the offsetting emission reductions is critical in determining how they affect air quality in another part of the airshed. The seasonal or daily time profiles of the proposed offsets are also very important in assessing their potential to improve air quality in the vicinity of the SE2 site. For example, an offset that reduces NO<sub>x</sub> emissions mainly in the winter will have no effect on summer ozone or secondary fine particle formation. A NO<sub>x</sub> or SO<sub>x</sub> offset in the southwestern corner of Whatcom County, for example, would be unlikely to have a proportionate positive effect on air quality in Abbotsford or Chilliwack.

Perusal of the 1999 emission inventory for all types of emission sources in the Fraser Valley Regional District in which Abbotsford lies indicates that there are few significant sources of NO<sub>x</sub> or PM emissions in the vicinity of Abbotsford. If the

proponent has been unable to come to terms with the owners of major point sources on potential offsets, it is unlikely that there exist enough other sources of sufficient strength to achieve the 1:1 offset of NO<sub>x</sub> and PM<sub>x</sub> that the proponent alludes to, especially considering the requirements for location and timing already mentioned.

**Q: Have you considered the possibility of finding offsets on the United States side?**

A: Yes. My statement is true for both sides. The Whatcom County 1999 Emission Inventory indicates that there are very few industrial sources with appreciable emissions of NO<sub>x</sub> or PM in the Sumas area that could conceivably provide sufficient emission reductions to offset SE2's emissions. Presumably SE2 has approached the operators of these facilities (including the SE1 plant) and has been unable to negotiate offsets with these nearby sources. There are only 14 major emission sources listed in the inventory throughout all of the county and most of the significant sources that might be able to provide offsetting emission reductions are in the Bellingham and Cherry Point areas. Emissions from these sources do not contribute significantly to pollution in the Abbotsford, according to my understanding of the available regional modeling results.

**Q: Can you comment on the Applicant's proposed alternative of simply contributing \$1.5 million in lieu of developing an offset program?**

A: Yes, there are two problems with this. First, if the idea is that the \$1.5 million would be used to bring about emission reduction programs at unspecified locations in British Columbia and Whatcom County, then obviously there would be no commitment to spend that money in a way that would offset the impacts to those people who are going to be breathing SE2's pollution.

Second, contrary to Martin's testimony that the amount is "generous and appropriate," the amount seems very insubstantial when compared to the costs of programs designed to reduce air pollution that have already been initiated in the Canadian part of the airshed.

I have been involved in surveys of potential offsets for NO<sub>x</sub> in the Lower Fraser Valley in several studies for private and public sector clients and have determined that typical cost-effectiveness values appear to be in the range of at least \$1,500-\$3,000 CAD (present value) per ton of NO<sub>x</sub> removed over the project's lifetime. Thus, a fund of \$1.5 million USD (about \$2.2 million CAD) might be sufficient to remove about 750 to 1,500 lifetime tons of NO<sub>x</sub>. This range corresponds to not more than 5 to 10 years worth of SE2's NO<sub>x</sub> emissions (at 145 tpy). The proposed \$1.5 million (USD) appears to be inadequate to offset fully even SE2's NO<sub>x</sub> emissions over a project life of 25-50 years, let alone offset other emissions like particulates and SO<sub>x</sub>.

**Q: Mr. Martin testifies that SE2's proposed \$1.5 million contribution should be considered significant in the context of funding air pollution programs. What have been the costs associated with the emission reduction measures you have been describing?**

While the emission reduction measures that have been pursued have been the most cost effective ones that does not mean that they have been inexpensive. Two studies of the costs and benefits of the emission reduction measures in the 1994 GVRD Air Quality Management Plan were carried out in 1994 and 1995. I co-authored both of those reports and was responsible for a major portion of the technical analysis. Those studies concluded that the direct cost to the public and private sectors of implementing the approximately 54 measures in the 1994 GVRD Plan would be \$2.9 billion 1993\$CDN (4% discount rate) over the period 1994-2020. This estimate included only direct control costs and not administrative costs. The preliminary cost estimates included, for example, about \$100 million to reduce NO<sub>x</sub> emissions and upgrade combustion efficiency at BC Hydro's Burrard Thermal Plant (about \$200 million was eventually spent) and about \$1 billion over the period to carry out the AirCare® light-duty vehicle inspection and maintenance program.

**Q: Let's turn to some other portions of the Applicant's pre-filed testimony. Mr. Martin suggests that Canadian authorities have not been aggressive in tackling air pollution. Is that an accurate characterization?**

**A:** The Province has been a partner with the Greater Vancouver Regional District (GVRD) and the Federal Government in developing all of the air quality management measures in the Lower Fraser Valley over the past 20 years. A few examples of specific initiatives that the Province continues to implement are:

- The AirCare® car inspection and maintenance program (1992, renewed 2000)
- Low sulfur diesel fuel regulation (1994)
- Gasoline vapour control regulation (1995)
- Motor vehicle emissions reduction regulation - requiring low emission vehicles to be sold in B.C (1995)
- Scrap-It older vehicle early retirement scrap program (1996)
- Diesel truck and bus on-road inspection program (1999)
- Sponsor of natural gas and fuel cell buses demonstrations
- Sponsor of alternative public transportation programs (e.g., Go Green, HOV lanes, various transportation demand management-TDM-programs).

It should be pointed out that the AirCare® inspection and maintenance program has recently (2000) been revised to incorporate an advanced IM240 testing protocol. It is also relevant that such programs are only required in the United States in non-

attainment areas. AirCare® came about as a result of strong local public and political will to address air quality.

In addition, I might add that the 1994 GVRD Air Quality Management Plan was the first urban regional AQMP in Canada. The Greater Vancouver Area and the Montreal Urban Community are the only urban regions in Canada to have local authority over air emissions and air quality management. GVRD has been delegated air pollution control authority in its jurisdiction by the Province. The rest of Canada has looked to Vancouver as the leader in air quality management initiatives for 20 years.

The 1994 GVRD AQMP was an aggressive approach to reducing emissions by 38% overall from 1985 levels by 2000. According to the most recent accounting, this target was essentially achieved by 1999.

The Fraser Valley Regional District (FVRD), which has jurisdiction over the municipalities in the eastern portion of the Canadian Lower Fraser Valley, also has established an Air Quality Management Plan as of February 2000. FVRD has applied for air pollution control authority similar to GVRD's but at present, the Province is the air pollution regulator for the FVRD.

Both regional districts are actively considering measures to continue the emission reduction trend in the face of diminishing returns in terms of cost-effectiveness with respect to traditional emission sources. The recent renewal of AirCare® with a more stringent testing protocol is evidence of the continuing programs in the region.

**Q: The Applicant has been very critical of Canadian commitments to regulating emission sources in the airshed. What are your comments on past experience with environmental assessment and permitting of existing and proposed emission sources in the Lower Fraser Valley?**

**A:** First of all, the Applicant's statements would come as a great surprise to the many industrial and public sources of emissions that have been involved in the extensive emission reduction programs over the past 15 years that I have already described. I have acted as consultant to a number of private sector proponents of projects in the Canadian Lower Fraser Valley over the past 12 years. Two of these projects have been large combined-cycle gas turbine power plants of the order of SE2 in size. The clients in these cases are confidential, and there is no formal documentation of the statements that I am about to make, because, in both cases, after preliminary assessment of, among other factors, the likelihood of being able to obtain permits to operate in the airshed, the projects were abandoned. No assessment process applications were prepared. I advised the proponents in those situations that, given the prospect of the GVRD's Air Quality Management Plan, which was in development at the time (early 1990s), it would be very difficult to conclude the

required permitting processes successfully. These proposals preceded the B.C. Environmental Assessment Act, which was promulgated in 1995, and established stricter scrutiny of projects with adverse environmental effects.

**Q: Mr. Martin testified about the laxity of emission regulations by Canadian regulators. Do you agree with Mr. Martin's characterizations?**

A: Statements in Mr. Martin's pre-filed testimony about the laxity of emission regulations by Canadian regulators are not borne out by the record of achievement that I have already outlined. Mr. Martin would have us believe (a) that air quality is so good in the Lower Fraser Valley that his project ought to be allowed to proceed, but (b) that Canadian regulators are so lax and Canadian emitters so apathetic that they had nothing to do with the current state of air quality (it must have happened by magic). Based on the information presented above, it is future air quality that all of us need be concerned about, and a concerted effort and expenditure by all stakeholders on the Canadian side of the airshed have produced the observed improvements, which cannot be sustained without further emission reduction measures.

**Q: Mr. Martin and Mr. Hansen compare emissions from other power plants in Canada with those of SE2. Are those fair and accurate comparisons?**

A: Those comparisons are not fair and accurate. The Burrard Thermal Generating Plant was built decades ago--in the 1960s. It's silly to suggest that British Columbia is not committed to clean air simply because a plant built 40 years ago does not have all the technological advances that a new plant would have today. BC Hydro is, understandably, reluctant to walk away from a huge capital investment. So instead, BC Hydro and the BC government have addressed the situation through other means. One, the plant simply is not used that much. It is *only used when peak demand requires its operation*. Thus, while SE2 focuses on Burrard's emission rate (per hour), the plant is run at less than half its permitted output, and most years even less than that, so its total emission output is far less than SE2's is projected to be.

Second, Burrard isn't allowed to operate--peak demand or not--when air quality in the region is particularly poor. Martin is wrong when he claims that this limitation was ignored this summer. While there was an inversion, the deteriorating air quality did not quite trigger the automatic shut-down requirement. We were probably within a day of that trigger when a front moved through and the inversion broke up.

Third, the Applicant ignores the tremendous investment made to upgrade the plant. In 1993, the owners of that plant were required to reduce NO<sub>x</sub> emissions by 80% by installing selective catalytic reduction technology as a retrofit in response to re-

permitting requirements from the GVRD and the Province. Currently, Burrard is believed to be among the cleanest large simple-steam-cycle, natural gas-fired plants on the continent.

**Q What are your comments about the Applicant's comparisons to other proposed power plants in British Columbia?**

A: Mr. Hansen in his testimony refers to the current version of the Port Alberni Generation Project, which is going through the B.C. Environmental Assessment Process. He comments that the Port Alberni project if approved would emit "74% more NO<sub>x</sub> than S2GF for each megawatt of electricity produced." Ex. 183 at 9:24. It is unclear whether this difference would be true in practice, since the proponents in both cases are proposing essentially the same generation and emission control equipment. The Port Alberni proposal happens to be a much smaller plant than SE2 (265 MWe compared with 660 MWe) and would therefore emit far less peak or total NO<sub>x</sub>. In any event, this project has not received any governmental approvals. At this time, conclusions can be drawn only from what that applicant has sought, not from what the government has approved.

The other Canadian example cited (the Island Cogeneration Project) is less than one-half the size of SE2 (245 MWe compared with 660 MWe) and is a true cogeneration project, with the adjacent pulp mill as steam host. The emission values in Hansen's testimony appear to be for electricity generation only, not taking into account the co-generated steam that displaces emissions at the mill host.

**Q: The Applicant suggests that before imposing more stringent requirements on new proposed air pollution sources that Canadian authorities should more stringently regulate existing sources. Is that typical on either side of the border?**

A: No. Mr. Martin's arguments about the laxity of regulating existing ("grandfathered") sources in the Canadian Lower Fraser Valley are difficult to understand. The U.S. Clean Air Act differentiates between existing and new sources. New Source Performance Standards, BACT or LAER requirements, etc. do not apply retrospectively to existing sources, unless they undergo significant modifications, or are otherwise required to participate in programs in non-compliance areas. In situations that I am aware of, new sources are always required to meet more stringent standards than existing sources. BACT for new sources is not the same as BARCT (best available retrofit technology) for existing sources. Effectively, all major industrial sources in the Canadian Lower Fraser Valley airshed have been engaged in emission reduction programs since the implementation of the GVRD Air Quality Management Plan in 1994. As pointed out earlier, the most cost-effective measures have already been implemented. Further, the criticism of the Canadian approach presumably applies equally to treatment of emission sources in Whatcom

County that Mr. Martin might expect to submit to regulatory programs to reduce emissions to offset SE2's emissions.

**Q: The Council stated in Order No. 757 that "at first blush, it appears " that the proposed changes address many, if not all, of the Council's concerns. Could you comment on that?**

**A:** I can see how "at first blush" the modifications may have seemed to address Effect's air quality concerns. But on closer scrutiny, that initial perception has not been borne out. The proposed modifications will have little or no effect on the air quality and health risk concerns that led the Council to recommend denial in Order No. 754.

**END OF TESTIMONY**

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BEFORE THE STATE OF WASHINGTON  
ENERGY FACILITY SITE EVALUATION COUNCIL

In the Matter of Application No. 99-1:

SUMAS ENERGY 2 GENERATION  
FACILITY

Exhibit \_\_\_\_\_ (YS-T)

PRE-FILED TESTIMONY OF  
YAROSLAV SHUMUK

**Q: Please introduce yourself to the Council?**

A: My name is Yaroslav Shumuk.

My business address is UMA Engineering, Ltd., 200-415 Gorge Rd. E, Victoria,  
British Columbia, Canada V8T 2W1.

**Q: What is the subject of your testimony?**

A: My testimony relates to the project's potential to exacerbate flood impacts in British Columbia.

**Q: What is occupation and employment status?**

A: I am a Senior Water Resources Engineer in the Water Management section of UMA Engineering, Ltd. in Victoria. UMA Engineering is a part of UMA Group, Ltd., which is an international firm with 30 offices throughout North America. UMA Group provides consulting, engineering, construction and management services to a broad base of public and private market clients. UMA Engineering, Ltd. provides civil, structural, mechanical, electrical and other engineering services. I am responsible for managing water resource projects involving hydrology, hydraulics, river engineering and computer modeling. In these projects I participate in the work and supervise groups of engineers and technologists who report to me.

**Q: Please describe your education and experience.**

A: I graduated from the University of British Columbia with a Bachelor of Applied Science degree in Civil Engineering, Water Resource Specialty, in 1976. After graduation I worked in the Hydrology Section of BC Hydro for three years, then one year as Water Quality Engineer for a coal mining company. Twenty-one years ago, I joined a consulting engineering firm called Ker, Priestman and Associates Ltd. that

later became KPA Engineering, Ltd., and then was bought out by my current employer, UMA Engineering, Ltd.

In the 26 years since graduation I have worked in the water resources field, primarily on projects or studies involving hydrology, hydraulics, river morphology, and computer simulation of hydrologic and hydraulic processes. In the last 15 years I have managed several floodplain mapping projects and studies that seek solutions to flooding problems in developed floodplains. In the past ten years, I have used or supervised the use of unsteady flow models in several of these studies. One of these studies is the Sumas Prairie Flood Hazard study that we became involved in two years ago. My experience and education are further described in my resume which is provided as Exhibit \_\_\_\_ (YS-1).

**Q: What materials have you reviewed in preparation for your testimony?**

**A:** I have reviewed portions of the following documents related to flooding and a description of the project:

1. Various letters containing comments on the Draft Environmental Impact Statement
2. Prefiled Testimony of Paula J. Cooper 23 June, 2000
3. Prefiled Rebuttal Testimony of David Carlton
4. Prefiled Direct Testimony and Prefiled Rebuttal Testimony of Katy Chaney
5. Sumas Energy 2's Post-Hearing Brief dated 5 September, 2000
6. [Proposed] Findings of Fact, Conclusions of Law, and Order dated September, 2000
7. Final Environmental Impact Statement
8. Council Orders 754, 759 and 760
9. Second Revised Application for Certification
10. Letters dated 21 August, 2001, 31 August, 2001 and 13 September, 2001 from Perkins Coie LLP to EFSEC regarding scheduling of future unsteady flow modeling SE2's flood consultants
11. Applicant's Prefiled Direct Testimony of Douglas Sovern
12. Applicant's Amended Prefiled Direct Testimony of Hsueh-Ju Chang
13. Draft Supplemental Environmental Impact Statement.

**Q: Would you please summarize the key points of your testimony.**

**A:** Yes. Essentially, I'll be making five points. One, the Second Revised Application fails to analyze flood events larger than the 100-year flood, even though analysis of larger floods is called for by EFSEC's rules and standard flood management practice in British Columbia.

Two, SE2's proposed fill of the site could cause a change in the routing of floodwaters to British Columbia's detriment. This possibility has not been analyzed and should be by use of an unsteady state model.

2

Three, SE2's proposed fill of the site will increase the height of floodwaters in British Columbia. Again, use of an unsteady state model is necessary to accurately quantify the extent of this impact.

3

Four, this area is prone to very severe flood damage in British Columbia. There is a real concern that the loss of additional flood storage capacity in this area will exacerbate this problem. Typically, flooding problems are exacerbated when storage is lost (filled) a little bit at a time. No single fill's impact on flood levels by itself seems particularly noteworthy. But the cumulative effect of many such fill impacts can be devastating. It is this incremental loss of flood storage capacity that is a major threat here.

4

Fifth, SE2 has offered nothing to mitigate for these flood-related impacts.

5

**Q: What are the features of the floodplain at the SE2 site that are relevant to your testimony?**

**A:** The SE2 site is located in the floodplain of Johnson Creek, which becomes the Sumas River floodplain farther downstream. The upstream end of the Johnson Creek floodplain is near the bank of the Nooksack River near Everson. During large floods on the Nooksack River, a portion of the Nooksack River flow crosses the divide into the Johnson Creek floodplain and flows north into Canada, therefore this floodplain also serves as a corridor for the Nooksack River overflows.

The Nooksack River drainage basin above the overflow point near Everson is about 13 times larger in surface area than the combined drainage area of the Sumas River and Johnson Creek upstream of the Canadian border. Therefore a minor portion of the Nooksack River flow can be many times greater than the total flow originating in the Sumas River / Johnson Creek basin. Because of this, when a large flood occurs on the Nooksack River, the overflows from the Nooksack River overwhelm storm runoff flows that originate in the Sumas / Johnson basin. These overflows travel down the Johnson and Sumas River floodplains into Canada, where they are typically detained for a time in a lowland area upstream of the Barrowtown Pumpstation before eventually draining to the Vedder and Fraser Rivers.

The occurrence of these Nooksack River overflows makes the flood characteristics at the SE2 site unique. During small storm events, the streamflows in Johnson Creek at the SE2 site originate from the Johnson Creek drainage basin only. However, once the Nooksack River exceeds the threshold level at which overflows begin, the magnitude of the overflow discharge increases very rapidly with relatively small increases in the Nooksack River level. The result is that the Johnson Creek and

Sumas River floodplain experiences relatively benign flood impacts from small storm events, but suffers widespread and severe flood impacts from huge volumes of overflow from the Nooksack River during the large events. Such a large increase in the severity of flood impacts does not exist for typical streams in this region.

**Q: Does the Second Revised Application acknowledge or discuss the site's vulnerability to flooding from both Johnson Creek/Sumas River floods and Nooksack River floods?**

A: No, the Second Revised Application does not appear to recognize the phenomenon that I described in my prior answer. I am not saying that the flood analyses carried out for the 100-year flood ignored the Nooksack overflows, but the fact that larger floods, such as the 200-year or 500-year, would be vastly more severe than the 100-year flood, in comparison to typical streams in the region, is not recognized. This is significant because the standards for flood analysis are developed for typical stream flood behavior, and the floodplain at SE2 is not typical. I believe that analyses for floods with higher return periods than 100 years are warranted for this site.

**Q: Please describe ongoing studies and efforts to develop a management plan for flooding in this area.**

A: As a result of the large flood that occurred in November 1990, which caused an estimated \$7.4 million (CAD) in damage in the Johnson / Sumas basin on both sides of the border, the Nooksack River International Task Force was formed with the objectives of reviewing the flood history of the area and providing recommendations on potential projects and solutions to alleviate flooding on both sides of the border. The Task Force is still active in that latter objective today, coordinating two series of flood studies, one on each side of the border.

The US study began in 1993, with Whatcom County as the lead agency receiving funding assistance from the Department of Ecology. KCM, Inc., a consultant from Seattle, was engaged to carry out the main engineering study of the flood problems on the Nooksack River downstream from Deming, including the Johnson Creek / Sumas River overflow corridor from Everson downstream to the border with Canada. More recently, Dr. Delbert Franz of Linsley, Kraeger and Associates, Ltd. has been retained by the county to develop a one-dimensional, unsteady flow model for the entire Nooksack River downstream of Deming, including the Johnson / Sumas overflow corridor to the Canadian border.

The Canadian studies began in 1994, with participation and funding from the British Columbia Ministry of Environment and the District of Abbotsford. As part of these studies, a one-dimensional, unsteady flow model was developed for the Sumas River floodplain downstream of the US border. The flood modeling work was carried out by Ken Wilson, who was employed by the Ministry until 1996 or 1997, then continued the work as principal of Wilson Hydrotechnical, Ltd. In 1999, as a result

of the retirement of Ken Wilson, UMA Engineering, Ltd. was retained to continue the flood modeling.

Due to the different funding schedules on both sides of the border, the studies have been delayed several times. At present, both the US and Canadian models are nearing the end of their development phase. In the next phase, it is anticipated that the models will be used to simulate 100-year and 200-year flood events to test various mitigation options that could alleviate the flooding problems in the Johnson/Sumas floodplain.

**Q: What size floods are being evaluated by the Task Force?**

A: The standard return period for several floodplain management tools, such as floodplain mapping, in the Province of British Columbia is 200 years. In Washington State, a 100-year return period is commonly used. To address this difference, current flood hazard studies that are being coordinated by the Nooksack River International Task Force are committed to analyzing both the 100-year and the 200-year events, so that the regulatory needs on both sides of the border are satisfied. All the work done by the Applicant (or proposed to be done in the future by the Applicant) for analyzing the impacts of the SE2 site uses a 100-year or lesser return period. These analyses should also be done for the 200-year event because the project impacts a jurisdiction (British Columbia) in which this is the standard for analysis and administration for floodplain management purposes.

**Q: Does the Second Revised Application address the 200-year flood which is the standard for floodplain management in British Columbia?**

A: No. Nor does it address the 500-year flood. In the Second Revised Application, the first page of Section 3.3 quotes the WAC 463-42-322 requirement for an application's coverage of water issues. One of these requirements is that the applicant identify the 5-year, 100-year, and 500-year flood boundaries, and all protective measures to protect against possible flood damage to the site and to the facility. WAC 463-42-322(3). However, there is no analysis of the 500-year event in the Second Revised Application nor does the application provide any explanation for this omission. Given the unique nature of flood behavior in the Johnson / Sumas floodplain, and that the site is directly in the path of flood waters during an Nooksack River overflow event, the requirement for the analysis of the 500-year event should not be waived. A facility designed to withstand a 100-year event with some freeboard (i.e., additional flood storage capacity) may be vulnerable to release of waterborne contaminants during a 500-year event. This is more likely if the magnitude of a 500-year flood is greatly increased over a 100-year flood, as it may be near the SE2 site, given the unique flood behavior caused by the Nooksack River overflows.

**Q: Based on your review, what effects of the filling of this site need to be addressed from a flood hazard perspective?**

A: There are two issues here. One, consideration must be given to the potential for filling of this site to reroute floodwaters in directions different than they would take without the fill. Second, consideration has to be given to the loss of flood storage capacity if this site is filled.

**Q: Let's take the first item first. How could filling of this site result in a rerouting of floodwaters?**

A: The topography near the SE2 site and downstream is gently undulating with low ridges and swales that direct overland flows in a complex pattern. In addition to the stream channels, railways and roads also have the potential to guide flood flows and add to the complexity. It is not possible from inspection of maps and past flood photos to determine how the fill at SE2 will affect the flow pattern. There is a small but definite possibility that the fill could divert the flows during very large floods in the vicinity of the SE2 site in a way that would redistribute the flows crossing the border into British Columbia. Because much of the length of the Sumas River in British Columbia has natural levees on both sides of its channel, this redistribution at the border could have consequences on the pattern of flooding for a considerable distance in British Columbia.

**Q: Does the Second Revised Application address this issue?**

A: No. Nor is it addressed in any of the other materials I have reviewed.

**Q: What would it take to analyze this issue?**

A: The only way to determine whether or not there are significant consequences to British Columbia as a result of the fill's potential to reroute floodwaters is to analyze the flow distribution with an unsteady model containing sufficient detail to simulate the different flow routes. This model should test the effects of the fill over a large range of flood events, such as the 10-year to 500-year floods.

**Q: Is there any particular type of unsteady flow model that should be used for this purpose?**

A: The model must be sufficiently detailed to be able to reliably account for the impacts of the proposed fill in this hydraulically complex area. A model that is too coarse in its detail can provide misleading or meaningless results. Also, to address the Province's concerns, the unsteady state model must extend into British Columbia at least as far as the Barrowtown Pumpstation to determine the impacts and effect of potential mitigation there.

**Q: How much time should be allotted for conducting this computer analysis?**

A: In our experience, the time required to set up, debug, calibrate, and run the models to determine impacts and test mitigation options is substantial. It would not be unusual for a study of this magnitude to require a period of six months or more, after all the required data is available.

**Q: Let's turn to the second impact you mentioned. Would the SE2 project cause a loss of flood storage capacity?**

A: Yes. The project would result in a net fill volume of approximately 130,000 cubic yards in the floodplain. The volume of this fill will occupy a three dimensional space that otherwise would store floodwaters during a flood event. This displacement will undoubtedly occur during both small and large flood events, and will cause local and downstream peak water levels to increase.

**Q: Will the increased water levels impact British Columbia?**

A: Yes. During a flood involving Nooksack River overflows into Canada, the floodwater typically becomes trapped for a time in the Sumas River floodplain between the border and the Barrowtown Pumpstation and floodgates, located about 10 miles (direct distance) into British Columbia. Flood water that is displaced by the SE2 fill will accumulate here and increase peak water levels in this area. Because the area of flooding is large, this increase in flood volume would be spread over a wide area and the incremental increase in peak flood heights would be small. However, specifying the magnitude of this impact with an appropriate degree of precision or certainty requires the use of an unsteady state model.

**Q: If the incremental increase in peak flood height in Canada would be small, do we need to be concerned with this issue?**

A: Yes. There is a major cumulative effects concern here. This fill would be one of many small incremental increases caused by other existing and future developments that, taken together, could create a significant increase to flood hazards in the floodplain. Current trends in floodplain management tend toward prohibition of any piecemeal filling in a floodplain so that regulatory agencies may defend against this creeping increase in flood risk.

**Q: Can you provide examples of this trend toward avoiding piecemeal loss of flood storage capacity?**

A: Yes. In 1990 King County in the State of Washington adopted a new restriction on floodplain development called a zero-rise floodway. This restriction prohibits development within the 100-year floodplain that would cause a perceptible rise in the flood level during a 100-year flood. The following quote from Customer Information

Bulletin 38 of the King County Department of Development and Environmental Services describes the intent of this restriction:

*"Development activity must not reduce the effective storage volume of the floodplain."*

In the mid-1990's the City of Surrey in British Columbia prohibited the placement of fill in a floodplain area known as the Serpentine-Nicomekl lowlands, specifically because the City recognized that placing fill on one parcel of land would make the effect of flooding worse on other parcels of land in the floodplain. It is planned that this policy will continue at least until a flood control project is completed that would bring an increased level of flood protection to all landowners in the floodplain.

KCM, Inc. in their Lower Nooksack River Comprehensive Flood Management Plan proposed three concepts to reduce the existing flood problem in the Johnson / Sumas floodplain. One of these concepts was to create more flood storage along this corridor to reduce the peak flow reaching the city of Sumas and entering Canada. To allow the fill for the SE2 plant would directly work against this possible solution to the existing flood problem.

**Q: Has the applicant proposed to create new flood storage or otherwise mitigate the impact of its displacement of flood storage in the Nooksack River floodplain?**

**A:** No. While Mr. Sovern suggests mitigation could easily be accomplished (Ex. 187 at 5:37 - 6:2), it likely would require a considerable amount of work to develop an adequate mitigation proposal and the prospects for complete mitigation are far from certain. First, if mitigation involved acquiring land or acquiring the right to increase the flooding on another owner's land, then this could be costly and it might be difficult to find landowners willing to cooperate. Further, the location of the compensating storage site would be critical. Acquiring a right to flood an equal amount of land somewhere else in the floodplain would not necessarily mitigate the impact of losing this flood storage capacity at this particular location. Floods are dynamic events, and the compensating storage must be effective at the same stages of the flood that the fill will displace. It would take a great deal of work to determine not only how much compensating flood storage capacity is required but also where it needs to be located in three dimensional space to offset the loss of flood storage capacity represented by the filling of this site.

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**END OF TESTIMONY**

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